JOURNAL *of* FORESTRY

November

1938

Vol. 36 No. 11

SOCIETY OF AMERICAN FORESTERS 1900

Published by the

SOCIETY of AMERICAN FORESTERS

Single Copy Fifty Cents Four Dollars per Year

ANNUAL MEETING COLUMBUS, OHIO DECEMBER 15, 16, 17

JOURNAL of FORESTRY

OFFICIAL ORGAN OF THE SOCIETY OF AMERICAN FORESTERS
A professional journal devoted to all branches of forestry

Entered as second-class matter at the post-office at Washington, D. C. Published monthly.

Acceptance for mailing at special rate of postage provided for in the Act of February 28, 1925, embodied in paragraph 4, Section 412, P. L. and R. authorized November 10, 1927.

Office of Publication, Mills Bldg., 17th and Pennsylvania Ave., N. W., Washington, D. C.

Manuscripts intended for publication should be sent to Dr. Henry Schmitz, Division of Forestry, University Farm, St. Paul, Minn., or to any member of the Editorial Staff. Closing date for copy, first of month preceding date of issue.

The pages of the JOURNAL are open to members and non-members of the Society.

Missing numbers will be replaced without charge, provided claim is made within thirty days after date of the following issue.

Subscriptions, advertising, and other business matters should be sent to the JOURNAL OF FORESTRY, Mills Bldg., 17th and Pennsylvania Ave., N. W., Washington, D. C.

CONTENTS

Editorial: Cooperative Forest Protection: Can It Succeed? 1097

Rural Community Planning 1099
PAUL A. HERBERT

Snowshoe Hare Useful in Thinning Forest Stands 1107
W. T. COX

Recent Developments in Cooperative Opportunities Between Federal and State Forest Agencies 1110
HOWARD HOPKINS

The History of Shipmast Locust 1116
ORAN RABER

Relative Durability of Black Locust and Shipmast Locust when Subjected to Four Wood Decay Fungi 1120
E. RICHARD TOOLE

Methods of Stratification for Loblolly Pine Seeds 1123
A. L. MACKINNEY AND W. E. MCQUILKIN

A New Day in the Naval Stores Industry 1128
V. L. HARPER AND T. A. LIEFELD

The Effect of Vegetation Upon Snow Cover and Frost Penetration During the March 1936 Floods 1131
C. H. DIEBOLD

Sustained Yield Versus Clearcutting—A Hypothetical Case 1138
A LUMBERMAN

Comments 1142
J. M. WALLEY AND W. S. BROMLEY

Soil Adaptability of White Spruce 1145
J. H. STOECKELER

The Relation Between Mycorrhizae and the Development and Nutrient Absorption of Pine Seedlings in a Prairie Nursery 1148
A. L. MCCOMB

Briefer Articles and Notes 1155
Annual Meeting; Comparative Infiltration in Forest and Open; Survey of Soil and Water Conservation and Flood Control in Foreign Countries; Wolf Packs; Direct Seeding in the Northern Rocky Mountain; Is Spring or Fall the Better Planting Season?; Forestry Education in Finland; Erratum; Chronica Botanica.

Reviews 1163
We Too Are the People; Famous Trees; Mechanical Properties of Certain Tropical Woods, Chiefly from South America; If and When it Rains; Eighteenth Annual Report of the Forestry Commissioners for the Year Ending September 30, 1937; The Sawmill Industry in Scandinavia and Finland and the Exports of Sawn Softwood from the Countries; The Cambium and Its Derivatives. X. Structure, Optical Properties and Chemical Composition of the So-called Middle Lamella; The Visible Structure of the Secondary Wall and Its Significance in Physical and Chemical Investigations of Tracheary Cells and Fibers; The Structural Variability of the Secondary Wall as Revealed by "Lignin" Residues; The Orientation of Cellulose in the Secondary Wall of Tracheary Cells; The Significance of Certain Wood-Destroying Fungi in the Study of the Enzymatic Hydrolysis of Cellulose; Cell Wall Structure of Higher Plants.

Correspondence 1171

JOURNAL OF FORESTRY

VOL. 36 NOVEMBER, 1938 No. 11

The Society is not responsible, as a body, for the facts and opinions advanced in the papers published by it. Editorials are by the Editor-in-Chief unless otherwise indicated and do not necessarily represent the opinion of the Society as a whole.

EDITORIAL

COOPERATIVE FOREST PROTECTION: CAN IT SUCCEED?

IN an address before the 63rd annual meeting of the American Forestry Association, F. A. Silcox, chief of the U. S. Forest Service, stated that a national forest policy can be achieved "by starting at the bottom and working toward the top;" that is, "starting with the forest land owners themselves and working up through the counties and states, and the federal government cooperating all the way." Although there may not be a very great number of clear-cut illustrations of this democratic ideal in American forest administration, there are some, and these deserve more than casual consideration by those advocating public regulation of privately owned timberland. It is possible that these examples, if carefully scrutinized and explored, would show the possibilities and limitations of cooperative effort in forest administration and protection.

The Southern Idaho Timber Protective Association is probably one of the more successful cooperative forest protective agencies in America. Organized under the provisions of a "gentleman's agreement" in 1908, this association now protects approximately 1,502,000 acres of cutover, brush, and timberland lying south of the Salmon River, Idaho. Assessments are made on about 600 thousand acres of the total area. One large lumber company and the State of Idaho each contribute somewhat over 40 per cent of the total protection fund expended by the association; miscellaneous subscribers and nonmembers contribute about 13 per cent of the total. During the year 1937 members and subscribers contributed over 17 thousand dollars; nonmembers about 840 dollars, and Clarke-McNary contributions amounted to slightly over $4,600.

The association has invested in camp equipment and tools, in autos and trucks, in telephone systems, and in buildings and in lookout stations almost 50 thousand dollars.

The available data indicate that the Southern Idaho Timber Protective Association has been unusually successful in controlling fire losses. Between 1914 and 1937 the total area burned was 109,155 acres, or an average of 4,548 acres per year. This amounts to .41 per cent per year of the area protected, which, considering the existing hazards, is exceptionally good.

The association has not confined its protective efforts merely to the control of fire. Timber on the association area has been subjected to numerous insect attacks, the most serious of which were the pine butterfly epidemic in 1920-1922, the saw fly epidemic on lodgepole pine in 1923-1924, and the spruce bud worm on spruce and fir. Since 1926 the mountain pine beetle has caused extensive damage to

lodgepole pine. In all these cases and in others, the association appears to have cooperated with experts from the U. S. Department of Agriculture and to have followed out all possible control measures.

Probably even more impressive than the fire record of the Southern Idaho Protective Association is its stated objective to "keep Idaho forest land productive, whatever the future may bring in ownership status." Furthermore, the annual report of the secretary for the year 1937 includes the following enlightened statement: "The necessity of adequate forest protection over this important timber area, in the common interest of water conservation, grazing, lumbering, recreation, and the related industries and activities of community life in southern Idaho is obvious. That the maintenance of its natural productive ratio should never be lowered is the natural desire and common interest of all. The stock raiser, farmer, and lumberman are all naturally desirous of leaving a 'going concern' to posterity. Now that Idaho—by its two fine statutes on 'Forest Protection' and 'Reforestation' —has evidenced the desire of her citizens and their understanding, in fact, of the problems that have beset the owners of timberland, there is hope that the reforestation of the Boise, Payette, Weiser, and little Salmon watersheds has become possible and practical and is really a 'going concern'."

The past record of performance of the Southern Idaho Protective Association should satisfy even the most skeptical of the possibilities of successful cooperative action of public agencies and the private timberland owner under certain conditions, and it serves to indicate that the private timberland owner is becoming increasingly conscious of his responsibilities to keep forest land productive.

Opponents of public regulation may claim that because of the success of the Southern Idaho Timber Protective Association and other similar associations public regulation is unnecessary. A careful consideration of the Southern Idaho association reveals, however, that the long time future of even this association is none too bright. In 1914 only 1.5 per cent of the area protected had been cutover; by 1920 the cutover area had increased to 9.3 per cent; by 1930, 28.1 per cent and by 1937 to 49.18 per cent. What will happen when the cutover area reaches 80 per cent, 90 per cent, or 100 per cent? Will the private contributors still pay annual assessments to protect unmerchantable timber? Unless the future of protective associations turns out to be somewhat different from the past, the answer may be found in the past experience of other timber protective associations in northern Idaho and elsewhere.

Important though adequate protection is and significant though the contributions made by protective associations may be, cooperative timber protective associations are not enough. A reasonable approach to a sustained-yield principle must be made. This indeed is the heart and soul of the problem.

It is possible that under present economic and legislative conditions the private timberland owner cannot operate on a sustained-yield basis. In any event activities such as those carried on by timber protective associations do assure more highly productive cutover areas for whomever may find it possible or necessary to administer them in the future. If the federal government cooperated more extensively with organizations such as the Southern Idaho Timber Protective Association, it is reasonable to assume that still greater progress could be made in acceptable forest management. Certainly public regulation of private timberland if and when attained, should not discourage voluntary self-regulation as exemplified by existing timber protective associations.

RURAL COMMUNITY PLANNING[1]

By PAUL A. HERBERT
Michigan State College

During the past five or six years many states have established planning commissions and these have assembled large amounts of data concerning the natural resources and people of the states or other political units. The author of the following article has been a member of the Michigan Planning Commission. He has had wide experience in rural community planning and is therefore well qualified to discuss the subject. Foresters engaged in rural planning or rural land zoning will find Professor Herbert's article of special interest.

COMMUNITY planning should connote a deliberate effort to develop a community so that it will sustain permanently the maximum number of gainfully employed, healthy, and contented families. The criterion of what is a happy and contented family naturally varies with the people, time, and place. Certainly, the community to be permanent must permit its inhabitants to enjoy a standard of living comparable with that enjoyed by a similar people residing within migratory distance (2).

Ideal community planning should not only result in a permanent community, but as plans fructify and as our knowledge of production technic and social organization increases, the community gradually should provide a livelihood for more people or a richer living for those already located there. The exceptions are communities whose development is based in whole or in large measure upon the exploitation of nonrenewal natural resources, the exploitation of the surplus of renewable resources, or upon the destructive appropriation of the normal sustaining seed stock of renewable resources. Such a community even with the best effort of the planner may face a period of adjustment and contraction; it may lose its identity entirely unless other means of livelihood can be found for the inhabitants.

Of course, community boundaries will vary from time to time not only because of the depletion of available natural resources, but because of social, economic, and political changes. Indeed, the very definition of a community permits shifts in boundaries without seriously violating the concept that a community is "an aggregation of individuals who are associated because of similar interests, activities or privileges." (11). Even the more detailed definitions allow considerable latitude; for example, Dr. Thaden's which is "that local area which is tributary to a center of common interest and activities, where at least a majority of the people obtain their daily and weekly needs and wants." (18).

There are many means employed to determine community boundaries, the least of which are the land lines laid down by the early surveyors. The usual determinants are the commoner services required by the inhabitants such as the location of church, high school, bank, post office, grocery, hardware store, local paper, and so on. Geographical barriers when truly barriers are decisive, but as such features are, of course, lacking in a large part of the country and as the other measures seldom coincide, much is left to the judgment of the planner. Certainly, the boun-

[1]Delivered at the Second Short Course in Forestry, College of Agriculture, University of Missouri, Columbia, Missouri, February 3-4, 1938.

daries of existing political units seldom agree with the boundaries of a dynamic community. Thus, in five-and-one-half counties in southern Michigan it was found that only 6.6 per cent of the community boundaries agreed with the township boundaries (17).

Nevertheless, planners must recognize the social community if their plans are to function, even though such community boundaries are as yet not generally recognized as legal entities. North Carolina is one of the states that does permit the social community as defined by trade, educational, religious, and recreational relationship to organize for other than civil purposes (13). Eventually, community planning will bring about a rationalization of the political community with the social community because such an adjustment is vital to optimum community development.

However, regardless of how and with what exactness community boundaries are defined, the ideal planning, to better living conditions for both the present and future is seldom fully realized. Governmental agencies, even if they do not always prepare the plans must most certainly execute them with the force of law if the plans are to be fully effective. They must consider the present group of society paramount even though such agencies also are presumed to represent future generations; planning cannot markedly favor posterity to the detriment of the present. Hence, planners are faced with the need of applying adjustments gradually to correct existing practices and conditions although future generations will suffer obviously even under such adjustments.

It follows from the preceding statements that a plan of community development once adopted does not preclude future changes. Planning is a dynamic process, subject to change not only as society becomes more altruistic and farsighted but also as our knowledge increases and as planners become more versed in their task. Any effort to force a community to develop rigidly within the pattern of a previously developed plan would be unfortunate and would presume to endow the makers of the plan with a knowledge and foresight that they could not have possessed.

It is for these reasons, too, that initial attempts at planning need not await the completion of meticulous and detailed inventories, nor await upon their perfect analysis; were planning to await their completion there would never be any planning. All that we can expect of our planners is the exercise of judgment, restraint and the full use of all readily available information; the more meager the data, the more extensive and tentative the planning. The planner of today cannot be a timid soul, he must have the courage and vision of the pioneer.

Endowing the planner with the characteristics of the pioneer does not imply that planning is a new departure. Even before man left his cave in the hillsides and congregated in groups we have evidence of community planning. Community organization occurred everywhere, but planwise development of physical resources was first undertaken with denser concentrations of populations, in cities and villages (19).

Nevertheless, planning as we conceive of it today, especially when applied to the rural community, is only now coming to the fore. So now is the time to plan planning and avoid costly errors that will set back and discredit rational community planning. Probably the most essential to the planwise development of a community is the preparation of a master plan including therein every factor of community life and relegated it, in so far as can be determined, to its proper sphere of influence and importance. This would also mean the establishment of priorities in the fact finding projects that needs must precede or accompany the planning of most phases of community organization.

The lack of rational priorities in fact

finding projects is in part to blame for the wave of social unrest and actual suffering among our conservative rural population. Our researches and successes in the technological phase of agricultural production have far outstripped the nation's ability to absorb that production to best advantage. All of this could not have been avoided, but I do claim that more thought and courageous effort expended upon the social-economic phases of our complex twentieth century civilization could have ameliorated the present situation thrust upon us by changes in the social and technological status of the nation. Had more of our energies and monies been expended upon the more difficult and more intricate social-economic problems, we would now be in better position to cope with this acute rural situation; had we instead of heeding the boastful and incessant demands of the production technicians flushed by comparatively simple successes, turned our attention to the almost untouched field of humanistic researches, we as a nation would today be enjoying greater happiness and contentment.

The master plan should include, therefore a community plan of research which would aid in preventing similar situations in the future. Such a plan simply considers unsolved problems as a part of community development, each specific research project just a phase of the community problem—to be planned and executed only in relation to the whole. It is not practicable, nor would it be necessary, for the successful application of this method of approach to carry on all experiments strictly from the point of view of one community. Experiments in animal nutrition, genetics, and so on, would be conducted as heretofore, except that their places in the research sequence would be determined by the present community need. All such projects, too, would be executed in so far as possible in the environs of those local communities in which the results are most urgently needed.

However, whenever the nature of research permits, projects should always be planned and executed strictly from the point of view of some specific local community. It is obviously impossible and unnecessary to study all problems in all communities with the same degree of minutia. It will usually suffice to study a problem in detail in a series of key communities, representing all the prevailing community complexes upon which the solution of a specific problem may have an effective reaction. All other communities, then, in which this problem is of moment, will be comparable to one of the key communities where intensive study is undertaken, and the conclusions there determined can be applied in these other comparable communities, by making such adjustments as are found necessary from a comparative study of essential differences between them and the key community.

This unit plan presupposes that we are appraised of all the static and dynamic factors as they exist in each key community. Every piece of research must be considered in the light of its effect upon these forces. Then, for instance, a problem will not be solved, as it is now, when the production technician discovers how to secure a more bounteous harvest. Before his discovery can be recommended, indeed, often before it is made, it must be considered in relation to its effect upon the entire economic, technological, and social structure of the community. Where are the markets for the product, and how much can be absorbed without depressing the price sufficiently to wipe out the profit? What are the probable trends in cost, and demand? Can the demand be increased? If so, how and to what extent? What are the physical, technological, and economic risks to which the product is subject? Does its production fit into the present and recommended

husbandry practices of the community? Does it run counter to any social or religious traits? Finally, to what extent should the producer in this community place reliance for his income upon this commodity? Only when these questions have been answered should the discovery be publicly advocated.

To prepare a community master plan, or at least to assist in the collection of facts necessary for such a plan every governmental agency from the federal government to the lowly township should have a steering committee, in the popular parlance of the day—a planning commission. These commissions should and often do consist of qualified representatives of the several applied sciences envolved in community planning, broadly classified as agriculture, economics, engineering, forestry, political science, and sociology. A well balanced commission would include in its membership men and women representative of competitive business, of public administration and of academicians; too many business men might be as unwise as too many politicians or professors.

Such commissions have blossomed forth everywhere under the golden ministration of the federal government; many and thick are the volumes that have been prepared by them.[2] These publications generally outline facts concerning the natural resources and the people of state or other political units. As initial efforts they have been well worthwhile.

However, whether even the general recommendations of these planning commissions will be followed is another question. The Indiana Planning Board for instance, lists in tabular form 29 planning problems with priorities for a ten year public works program for every county (4), but the commission has no authority to enforce its recommendations. Iowa in 1933 prepared a 25-year conservation plan (5). It's a fine paper plan, let us hope that it will be followed. In Michigan with a purely advisory and fact finding commission, I know of two publicly financed comprehensive survey and inventory projects both independently preparing large scaled maps for the entire states requiring about the same type of field examination and gathering much similar information.

So it is necessary to obtain not only cooperation but positive coordination between the advocates of and specialists in any phase of community planning, with those interested in other overlapping phases. Advisory commissions will aid, but can never entirely eliminate gaps and conflict in the preparation or in the execution of community plans. Some agency (whether it be the planning commission is debatable) must be given the power to force coordination; in a state the budget officer might be given that responsibility, in a city the mayor or city manager and in the county, a committee of the governing body.

I make the preceding statement fully recognizing that much has been accomplished by advisory groups. The County Council of Chester County, Pennsylvania, an advisory body, has accomplished much to integrate both public and private social, economic and physical projects in the county (3). However, even with the fullest desire to cooperate well meaning citizens, who understand the importance of some particular phase of community planning better than other phases, will sooner or later insist that they be permitted to extend their efforts beyond limits that others may deem justifiable.

Luckily, the type of planning projects that attract most popular support are very often those that any impartial investigation would list as being of prime impor-

[2]Connecticut, Florida, Iowa, Michigan, Minnesota, New York, North Dakota, Pennsylvania, and Wisconsin are among those states who have been particularly prolific.

tance. A study of the reports of state planning commissions shows that the same projects are under consideration in many states. Iowa devides its problems in four classes: Land, water, people, and commerce (6). Under "commerce" are listed highways, radio, telephone, telegraph, gas, cost of living, wage trends, trading centers, and mineral resources. Under "people" we find migration, trends in age composition, martial status, crime and delinquency, adult education, health, library service, rural education, farm housing, ownership and tenancy, recreation, public financing, rural zoning, historic sites, etc. Under "water" are listed flood control, stream pollution, waste disposal, stream improvement, water supply, etc. Under "land" we find studies in productivity, farm management, soil conservation, public and private forests, and wildlife conservation, etc.

Obviously, any one person would not be competent to organize all of these community projects. However, we must develop an individual who can coordinate the work and plans of the specialist so that each part of a community plan receives its proper priority and emphasis. Such an individual might well be called a community planner and would have administrative control of all fact-finding projects and their analysis.

As the plan, or parts of the plan, are completed and approved it would be turned over for execution to the administrative group or the community manager. Ordinarily, to obtain the best results the community planner and the manager should be independent of each other; however, the planner must be able to visualize practical limitations in his planning and the manager must be in sympathy with community planning and give the various planned developments a fair opportunity to show their worth.

Ordinarily it will be found that plans will function most effectively not only if prepared with local assistance, but even more so if administered locally. Taylor, making his studies in Vermont some years ago stressed both of these points (16). The experts from outside who in most cases gathered the facts and prepared the material worked as advisors to local Vermont committees. Clarke (1), however, points out that while it is essential to make planning a local undertaking, that state and federal assistance is usually necessary in rural communities to finance a planning program.

Regardless of organization or financing community planning does not abrogate in any sense constitutional rights and liberty enjoyed by individuals in a democracy. Community planning simply attempts to increase opportunities for a richer living by improving those conditions over which the individual has little or no control. The extent to which the community has and will force acquiescence by an individual to any particular phase of community organization does not change the situation if it be legally arrived at. The individual has no absolute nor unalterable rights in society.

The remainder of this paper will be confined to just one phase of community planning with which I am somewhat familiar—rural land planning. Michigan pioneered in the systematic collection of facts for rural land planning both because of the extreme malutilization of land there and the vision of one man, P. S. Lovejoy (12). But Michigan lacked the courage to analyze its facts, while Wisconsin with fewer facts at its disposal but with a willingness to experiment has prepared plans and through zoning has enforced these plans in many rural communities (20) Michigan has still to prepare its first rural zoning ordinance. Michigan did prepare a land use map of several counties in Michigan showing just how the data gathered by the Michigan Land Economic Survey might be used as a basis for land use planning (15).

Rural land planning both in Michigan

(14), and Wisconsin has grown up chiefly under the guidance of foresters and soil specialists. It is only natural that they should emphasize their specialties. On the other hand, in New York, (10), and Minnesota, (7), leadership has been taken by agricultural economists. It is my opinion that while probably not as broadly trained as desirable, agricultural economists are, in general, the best qualified rural land planners now available. It is true that such physical resources such as forests, waters, and especially soils are basic to rural land planning but it does not follow therefrom that specialists in these fields are land planners.

In recent years soil specialists in mapping soils have been inclined to step out of their field and classify land on the basis of its economic availability for various purposes (8,9). Soil classifiers, as soils men, should confine their efforts to the mapping of soils upon its physical capacity to produce various crops. Probably it was necessary and desirable to first classify soils by their physical and chemical nature upon which basis, particularly the physical, most soils mapping has been done. Such a classification has resulted in a large number of soils the number in some cases dependent almost as much upon the hair splitting character of the surveyor as on the physical differences. Only recently have soil surveyors discovered that the laymen has found it difficult to use intelligently the detailed classifications and that for some purposes including the determination of assessed values and land planning, a much more general classification is necessary. Missouri now has 175 soil types. Tompkins County, N. Y., has 33, but the land classification map prepared by an agricultural economist consists of but five classes.

Before land classification maps can be prepared not only should the soils be classified, but much other equally as pertinent information must be compiled. In New York, for instance, land use maps are considered extremely significant (10). A farm class map also is prepared, classifying the farms on the basis of their success as a business enterprise. With the aid of such economic and social information, the rural area is placed in a few land classes that can then be used as a basis for rural zoning. It was found in Tompkins County, N. Y., that except for the very poorest soils and the very best soils, an appreciable percentage of each soil type was finally found to be included in each of the five land classes.

After the land has been classified on the basis of all the known physical, economic and social factors, a zoning ordinance and map can be prepared which, while based upon the land class map, may be considerably modified for political or administrative reasons. The various zones of use should be clearly outlined on the map and described in detail in the ordinance. It should be remembered that broad zones based upon the most obvious and fundamental uses can be more easily defended in the courts under the general public welfare, health, and safety clauses either expressed or implied in our state constitutions. Actual court tests covering the broad principle of rural zoning must still be made. Wisconsin authorities have thus far avoided occasions for court tests.

It is very desirable that non-conforming land uses in any land use zoning district should be carefully recorded to avoid future litigation as to whether these uses were established before or after the zoning ordinance was adopted. Of course, non-conforming uses established prior to the enactment of a zoning ordinance cannot be disturbed. They can only be eliminated at this time by persuasion and public purchases. So, in established communities where non-conforming uses are present, zoning should be accompanied by some plan to eliminate such uses. Acquisition of farm properties in forest land zones will at times reduce in one year

school and road costs more than enough to offset the purchase price of the property.

Planners must remember that in this country, at least, the mere enactment of a law will not result in its effective administration if the community affected is not in sympathy with the purpose. However, it is also undesirable to allow too much local option as a few unprincipled individuals may block the enactment of desirable legislation. Wisconsin for instance, requires that its rural zoning must be approved by majority vote in each township before it can become effective in that township. This has resulted in a few instances in individual townships that are not zoned although the remainder of the county is under a zoning ordinance. In Michigan zoning ordinance must only be approved by the county board of supervisors and the state planning commission after the voters of the county have approved of the principle of zoning (not the specific ordinance). I believe the Michigan method is usually to be preferred because it is not probable that the county board would enact a zoning ordinance that does not meet with general approval.

Rural zoning is not a panacea for all community ills. Nor will the solution of just the entire land use problem suffice. Advocates thereof will be disappointed unless they actively institute and support efforts for the planwise development of all phases of community life, for land planners must never lose sight of the fact that land planning is simply a means to an end—that of increasing human happiness.

Literature Cited

1. Clarke, N. 1934. Coordination local planning with state and federal programs. Amer. Civic Assoc. and Natl. Planning Conf. on City Planning. St. Louis.
2. Herbert, P. A. 1933. Rural land zoning, Mich. Com. of Inquiry into County Township, and School Dist. Gov.
3. Herring, J. W. 1933. Social planning and adult education. MacMillan Co. New York.
4. Indiana State Planning Board. 1937. County planning problems and their relative importance.
5. Iowa Board of Conservation and Iowa Fish and Game Commission. 1933. Report of the Iowa 25-year conservation plan.
6. Iowa State Planning Board. 1934. A report of progress.
7. Jesnes, O. B., and R. I. Nowell. 1935. A program for land use in northern Minnesota. Univ. of Minn. Press. Minneapolis.
8. Kellog, C. E., and J. K. Alleiter. 1935. A method of rural land classification. U. S. Dept. Agric. Tech. Bull. 469.
9. Kellog, C. E. 1937. Soil survey manual. U. S. Dept. Agric. Misc. Pub. 274.
10. Lewis, A. B. 1934. An economic study of land utilization in Tompkins County, N. Y. Cornell Univ. Agric. Exp. Sta. Bull. 590.
11. Lohmann, K. B. 1935. A community planning primer for Illinois. Univ. of Ill. Bull. 50.
12. Lovejoy, P. S. 1925. Theory and practice in land classification. Jour. Land and Public Utility Econ. 1:160-175.
13. Manny, Theo. B. 1930. Rural municipalities. Century Company.
14. Rowlands, W. A. and F. B. Trenk. Rural zoning ordinances in Wisconsin. Univ. of Wis. Ext. Circ. 281.
15. Schoenmann, L. R. A. 1931. Land inventory for rural planning in Alger County, Mich. Papers of the Mich.

Academy of Science, Arts, and Letters, 16.

16. Taylor, Vermont for Vermonters.
17. Thaden, J. F. 1933. Natural community areas. Mich. Local Gov. Series.
18. ———. 1938. High school communities in Michigan. Mich. Agric. Exp. Sta. Special Bull. 289.
19. Unwin, R. 1911. Town planning in practice. London.
20. Wisconsin Extension Service. 1934. Making the best use of Wisconsin land through zoning. Special circ.

Famous Mexican Cypress Healthy

LAST year the chief of the Mexican Department of Forestry, Game and Fish, Dr. M. A. DeQuevedo, appointed a committee consisting of Forest Engineers A. Roldan, J. R. Inda, and A. Dampf to investigate and determine the growth and present condition of the famous cypress tree (*Taxodium*) known as "El Arbol de Santa María del Tule" in the Province of Oaxaca.

This committee completed the examination on February 7, 1938, and reported that the ancient tree, which at a height of 3.2 feet above the ground has a circumference of 177.8 feet, is in full vigor and shows no fungi nor insect pests present. It continues to grow and promises to exist for many more centuries.—JNO. D. GUTHRIE, *U. S. Forest Service.*

SNOWSHOE HARE USEFUL IN THINNING FOREST STANDS

By W. T. Cox

Resettlement Administration

To many foresters the snowshoe hare is a nuisance without a single redeeming quality. The author regards the snowshoe hare as an important and active silvicultural agent in thinning dense forests at low cost.

THE snowshoe hare is well known to both the forester and the biologist. It is an important factor accelerating tree growth and reducing fire and insect damage in the northern forest clear across the continent.

Foresters are interested in the snowshoe hare because, under certain conditions, it can be injurious in tree planting operations. But what is of far more importance, it is highly beneficial in thinning thickets of pine, spruce, aspen and other species of trees a fact to which little attention has been given. Biologists are interested in this hare because it is one of the most pronounced cyclic species, becoming very numerous about every ten years and then dropping quickly to a "low" during which it may be exceedingly scarce.

For many years the writer has contended that the snowshoe hare, in its thinning operations, rendered a tremendously useful service to the northern forests. Numerous examples of widespread and valuable thinning work were observed during each of the last three periods when the hare was at "high" in its population curve. These examples were first observed in northern Minnesota in 1912. Further observations tending to corroborate the evidence of useful thinning were made in the Hudson Bay country, in Minnesota, and the northern Rockies in 1923, 1924, and 1925. When, in 1935-1936, an opportunity presented itself for careful and continued research to obtain more complete information on this subject, it was arranged to set up a "snowshoe hare study" as one of the important jobs under biological reconnaissance on the Beltrami Island (Resettlement) Project in northwestern Minnesota and Jack Manweiler, the project game manager, who is intensely interested in the subject, was assigned to conduct it.

Mr. Manweiler selected areas in different forest types, laid out and fenced in plots, constructed traps and carried on the work systematically with excellent and conclusive results. The data collected include rather striking figures as to the density of the stands of young trees and the need for thinning operations. The extent to which the snowshoe hare reduces the density of these stands and the age classes in which the thinning is done also are shown clearly. Table 1 gives the data obtained for four jack pine plots. Many similar plots show approximately the same results.

These data show that there should be no question as to the manner in which the snowshoe hare operates to improve thickets of jack pine. Other observations indicate that similar results are accomplished in stands of white pine, red pine, white spruce, balsam fir, and aspen in Minnesota, and in lodgepole pine stands in the Northern Rocky Mountain Region.

Since Nature is prodigal in the production and dissemination of seed of certain tree species, the need for thinnings is evident. Were it not for the snowshoe hare, it is practically certain that millions of acres of dense thickets would be formed which would suffer increased fire losses and damage from insects as well as from stagnation.

In northern Minnesota alone there are

twenty million acres of forest occupied by snowshoe hares. Of this area an average of 200,000 acres are cut clean or burned over each year and of this denuded area one-half or 100,000 acres are heavily seeded and come up naturally to dense stands of seedlings. These stands are generally so dense that they form "mats" or thickets in which the competition for moisture, root space and light is so keen that growth would be exceedingly slow if thinning were accomplished only as a result of the natural competition among the plants themselves.

When the seedlings become approximately four or five years old, they commonly reach a stage where growth in height and diameter practically is suspended. In other words, a very small amount of wood is being produced per acre. Were the little trees left alone, this condition would continue for years. Actually it continues only until the next "high" in the snowshoe hare cycle is reached.

Into these dense thickets of seedlings, six inches to two feet in height, the hares, at the high peak of their 10-year population cycle, come in thousands. They snip off and devour the smaller trees and girdle or prune the larger ones until the stand is so open and the cover so sparse that the hares no longer feel safe to remain where owls, hawks, and other enemies can see and catch them readily. The hares then move on to other thickets repeating the thinning operation. After one or two years the remaining trees on areas where eighty per cent or more of the stand was destroyed may have made growth sufficient to provide adequate concealment for the hares which again are attracted to the site. Another ten per cent or more of the seedlings are killed, this time largely through heavy topping, pruning, and girdling. If hare abundance continues for a sufficient length of time, say five or six years, even a third thinning may be made. But whether the hares remain long enough to make one, two or three thinnings, the effect on the forest is essentially the same. The stand is opened up to an extent sufficient to permit the remaining trees to recover from their stunted condition and resume rapid growth.

Table 1

THICKETS THINNED BY SNOWSHOE HARES
AVERAGE DIAMETER OF TREES .4 INCH

Plot number	Original number of trees per acre	Number of trees remaining after thinning	Per cent remaining
1	55,000	1,650	3.
2	23,340	980	4.2
3	3,180	10	.3
4	41,240	6,140	14.9

Average number of jack pine before thinning 30,690 per acre.

Average number after thinning 2,195 per acre —a good stand.

If it were not for the periodic abundance of the snowshoe hare, the hundred thousand acres of thickets that Nature annually establishes in northern Minnesota would remain practically unproductive for from ten to twenty-five years. During each period when the snowshoe hare is at "high" it thins one million acres of thickets. The normal annual growth of pine or spruce on a million acres amounts to 300,000,000 feet. If only ten years of stagnation in tree growth is prevented by the thinning operation performed by the hares three billion feet of timber is added to the forest stand and at $4 per M. this would be worth $12, 000,000. To accomplish as good a job of thinning directly through human effort would cost the entire twelve million dollars and be quite impracticable.

It is manifestly impossible to arrive at any figure representing the saving effected by the snowshoe hare through the reduction of fire and insect losses. But unquestionably this saving is very considerable.

If we assume the beneficial effect of the snowshoe hare to be the same through-

out its range, from Labrador and Maine to Alaska, as it is in northern Minnesota, it is apparent that this animal has great economic value in the Canadian plant life zone. Only one other animal may be of greater importance. The beaver, if better protected, through its water control activities and the consequent reduction in fire hazard might well be rated as the premier conservationist.

After the snowshoe hare has been approximately at "high" for several years, it will have eaten out a large part of the bushes and small tree growth suitable for food and available at the varying snow depths. It is then both restricted as to food and limited as to cover during feeding hours. And since the hare has to eat great quantities of its natural coarse food, it becomes hard pressed to maintain its vigor. This, together with greater exposure to enemies, no doubt contributes to sickness, predation and the periodic rapid decline in numbers.

The writer, some years ago, in a bulletin entitled, "Reforestation on the National Forests", called attention to the desirability of planting and seeding in the center of large recent burns or other openings rather than near the edge of the forest because of greater immunity from damage by rodents. Mice, chipmunks, and squirrels do not quickly become established over large, open burns nor do they or hares like to venture very far from cover while feeding. This tends toward a desirable condition in that border growth is longer maintained, uneven stands promoted and game carrying capacity of the area increased.

Another lesson is indicated in this study of the snowshoe hare. That is the advisability of light rather than heavy planting. A plantation dense enough to provide good escape cover for hares while the trees are still small enough and low enough to provide attractive food induces heavy losses from girdling and branch and top pruning. On the other hand, in light plantings the trees afford little cover and are likely to attain sufficient height and develop coarse enough bark to be immune to hare damage before good escape cover is formed.

47 States and 2 Territories Now Cooperating in Forestry

AGREEMENTS signed between the states of Illinois and Missouri and the U. S. Department of Agriculture bring to 47 the number of states now cooperating in forestry under the Clarke-McNary law, according to the Forest Service, which is charged with its administration.

The Clarke-McNary Law, passed in 1924, provides for the allotment of federal funds to states matching such appropriations for carrying on fire protection work in forests and furnishing forest tree seedlings for plantings on farms. The territories of Hawaii and Puerto Rico and all states except Arizona now participate in one or more phases of the cooperative program.

RECENT DEVELOPMENTS IN COOPERATIVE OPPORTUNITIES BETWEEN FEDERAL AND STATE FOREST AGENCIES[1]

By HOWARD HOPKINS
U. S. Forest Service

The problems facing the private owner of forest land may be approached through increased public ownership of forest land, public regulation, or cooperative effort. The author prefers the cooperative effort method. During the past few years at least six federal laws have been enacted providing for more extensive cooperation between the federal government and the private owner. The possible application and the possibilities of these laws are described in detail.

I FEEL that I am especially favored in the topic assigned to me for discussion, not only because I am especially interested in this subject, but because cooperative programs and projects between federal and state forest agencies and forest landowners are, and to an increasing extent will be, of vital importance to every forester, forest agency, forest landowner, and forest community.

Before taking up the subject proper, I wish to digress a moment in order to present a brief picture of the forest land situation and problem of this territory, through reference to a minimum number of figures. The six states of Pennsylvania, New Jersey, Delaware, Maryland, Virginia, and West Virginia have a total productive forest land acreage of 44½ million acres, covering over 50 per cent of the total land area in these states. Of these, 44½ million acres, only 2½ million acres are in National Forests, less than 2 million acres are in state forests, and just less than ½ million acres are in county or municipal forests. The total public forest area in the states within this section is therefore just over 4½ million acres, representing less than 11 per cent of the total productive forest land area, leaving over 89 per cent of the forest land area in private ownership. It is these 40 million acres of privately owned forest land concerning which I wish to speak, recognizing that our major forest land problem, or battle, in its broadest sense—improving our forest land so it will yield maximum benefits on a permanent basis—will be fought, and either lost or won, not on the public forest land area, but on the privately owned forest land. I might add that the privately owned forest land is apparently fairly evenly divided, between so-called "farm woodland," covering 42 per cent, and the so-called "commercial timberland," which includes 58 per cent of the total.

It is estimated by those in the best position to judge, that the farm woodland in this section, on the average, is today producing between one-third and one-half of the value in timber products which it is capable of producing, and that the commercial timberland on the average is in a less productive condition than the farm woodland, while the last census data I have available indicate the annual value of the wood products removed from the farm woodlands within the territory of this section to be in excess of twenty-seven million dollars. Couple this annual crop with the fact that this farm woodland area is less than half the privately owned forest land area, and the fact that this farm woodland is considered to be producing only one-third to one-half the value it could produce, and you have a crude picture of the vital importance

[1]Presented at the Annual Meeting of the Allegheny Section, Harrisburg, Pa., February 25-26, 1938.

nd value to our forest landowners and orest communities, both present and future, of improving the productivity of his privately owned forest land area on a permanent basis.

Accurate information as to the exact condition of the privately owned commercial forest land is not available. Nevertheless, during the past year we have collected the best information available on this matter from the extension and forest services of the states within this section. The available data indicate that only 2 per cent of the commercial timberland and $5\frac{1}{2}$ per cent of the farm woodland is being handled under sustained yield management, leaving 96 per cent of the privately owned forest land as a whole handled under all stages, or variations, of unsatisfactory management. Even if we included all privately owned forest land in this section which was reported under the classification of "land left in good growing condition," we find the total acreage forms less than 25 per cent of the total privately owned forest land concerned. These data, even though inaccurate and incomplete, yield the best available factual presentation of the present condition of the privately owned forest land.

The solution of this major forest land problem may, I think, be approached through one of three main avenues; namely, public ownership, public regulation, and cooperative effort. Each of these should, of course, participate in the solution of the problem, but in determining the *main* avenue to be used, I think, and hope you will agree, than an approach through a public forest land purchase program to convert to public ownership all, or most, of the forest areas not properly managed by private owners is obviously not practicable and is decidedly undesirable. Another main approach to solve our problem might be through public regulation of the owner's treatment of his forest land. This approach is, I feel, preferable to the public ownership approach but should be applied primarily to supplement other approaches, and should be applied as the *major* solution only if the third method fails. The third major approach to solve the problem is through cooperative action between all interested agencies; the forest landowner, the wood-using industry, and public forest agencies. Public agencies are vitally concerned in their own right in the placing and maintaining of forest land in a condition where it will yield maximum benefits on a permanent basis to the present and future residents and communities of the area concerned.

I think that at this point we can, in general, agree on three main items; first, that the 40 million acres of privately owned land, on the average, is in an unsatisfactory condition; second, that the correction of this condition presents a major forest land problem; and third, that of the three major approaches to solve this problem, through public purchase, public regulation, or through cooperative effort by landowners, woodusers, and interested public agencies, that the third or cooperative solution should be attempted.

If we can agree on these three major points, the next question is how can and should the forest land problem be solved by cooperative efforts. If I were submitting the question, I would add, "P.S. Please answer with a minimum of generalities and a maximum of specific suggestions."

I know you are all familiar with the valuable cooperative forest fire protective work accomplished under Section 2 of the Clarke-McNary Act, and under the cooperative raising of forest planting stock for use by farm woodland owners under Section 4 of this Act. I might mention, however, that this year the federal government is contributing \$140,000 and \$10,000 under Sections 2 and 4 of this Act, respectively, to the six states in the territory

of this section. I only need to mention the very valuable work accomplished by the Forest Products Laboratory at Madison, Wisc., and the Allegheny Forest Experiment Station at Philadelphia (in cooperation with local forest agencies and landowners), in solving technical forest problems of all kinds and in placing the results of their researches at the disposal of all interested persons.

Time and subject assigned me necessitate that I confine my comments to cooperative opportunities recently made available, or now being made available, for our use in solving our major forest land problems.

These opportunities are as follows:

1. Establishment of timber stand improvement and planting demonstration plots by C.C.C. resources.
2. Forest land purchases or acquisition, under the Fulmer Forest Law, under the former Resettlement Administration, under Title III of the Bankhead-Jones Law, or by cooperating agencies for municipal, town, or county forests.
3. Forestry practices in the Agricultural Conservation Program.
4. Soil Conservation District Laws.
5. Cooperative Farm Forestry Law.
6. Cooperative Sustained Yield Projects.

These six laws or activities are the tools available to us to solve major forest land problems. Is it fair to inquire how many of you have ever considered the possibility, practicability, and desirability of applying each of these six tools to improve forest land and stand conditions of any specific forest land area, or group of areas in your vicinity? While many of you are familiar with the opportunities offered by a number of these six tools, it may, nevertheless, be worthwhile to indicate briefly the past and possible application of each.

1. *Establishment of timber stand improvement and planting demonstration plots by C.C.C. resources.*—Two years ago Director Fechner authorized the use of C.C.C. labor and resources to establish demonstration timber stand improvement plots on privately owned forest lands to demonstrate to forest landowners in the vicinity how best to treat similar timber stands. Last year the Director also authorized the use of C.C.C. resources to establish planting demonstration plots for a similar purpose. These two authorizations have been utilized with very beneficial results through the cooperative efforts of the federal Forest Service, and the forest services and extension services of many states.

2. *The acquisition of privately owned land by public agencies under the Fulmer Act, or the former Resettlement Administration, or under Title III of the Bankhead-Jones Act, or by cooperative efforts to form municipal, town, or county forests.*—I think you are all familiar with the Fulmer Act passed by the Congress in 1935, which authorized an appropriation of five million dollars by the federal government to purchase lands for state forests, but under which no funds have as yet been appropriated. However, over 50 project areas have been selected, examined, and reported on, through cooperative efforts of the state and federal forest services, for action when funds are made available. The former Resettlement Administration initiated a submarginal land purchase program in the states of this section, and has acquired a number of forest areas which it is developing. Most of these forest areas are expected to be turned over to the states concerned as rapidly as possible under 99-year leases. It is expected that ten million dollars will be appropriated under Title III of the Bankhead-Jones Act for land acquisition during the fiscal year 1939. The Bureau of Agricultural Economics, which is handling land acquisition projects under this Act, has selected two or more project areas in each state, and it is expected that if these areas are approved they will be

acquired and most of them turned over to the state forest agency under long-term leases. New projects have recently been initiated in many states by towns, municipalities, and counties to establish their own public forests, to utilize land needing public ownership and development, and to benefit their residents. These cooperative purchase or acquisition programs are mentioned at this time merely to indicate possible tools for utilization in connection with those forest land areas which should be transferred to public ownership in order to place and maintain them in a productive condition, or to prevent further injury to public welfare.

3. *Forestry practices in the Agricultural Conservation Program of the Farm Act.*—Two years ago the Agricultural Adjustment Administration, through its Agricultural Conservation Program, provided benefit payments from base allowances earned by the landowner, for planting forest trees or seedlings on farm woodland areas. Last year the Agricultural Conservation Program also provided benefits for most of the states within this section for timber stand improvement work in timber stands on woodlands justifying such treatment. Entirely aside from the cash revenues obtained by the farm woodland owners through these practices, it is difficult to over-estimate the value of including these practices in the Agricultural Conservation Program from an educational standpoint. In some states the state forest service, the extension service, and Agricultural Conservation Program Committee have worked hand-in-hand with excellent results, while in other states this tool was utilized only to minimum extent.

The final 1938 Agricultural Conservation Programs for all states within this section have not yet been made available. I have, however, reviewed the available final programs and preliminary drafts of 1938 programs covering a majority of the states in this section, and find that in each case benefits for both planting and timber stand improvement work are made available. In addition to these benefits, this year the National Agricultural Conservation Program provides that all or any part of any payment under the 1938 Agricultural Conservation Program may be withheld if, "with respect to forest land or woodland owned or controlled by him, he adopts any practice which tends to defeat the purposes of a sound conservation program as prescribed by the Regional Director." Thus the 1938 Agricultural Conservation Program opens a door for each State Conservation Program Committee, on the advice of the extension and state foresters, to recommend what practices, if applied to farm woodland, it feels would defeat a sound conservation program. I think all would agree on the desirability of recommending that burning or setting fire to the woodland should be specified, most persons will agree that clear-cutting on steep slopes also should be specified, and some will agree that clear-cutting of any large area should be specified, as practices which would defeat a sound conservation program. The opportunity is given, however, through this tool to formulate and develop an informational and educational program that will be listened to as never before. I am glad to say that a number of the states within this section have strongly recommended that this section of the National Agricultural Conservation Program be utilized, and I expect to see it utilized very effectively this year, and increasingly so in the future. The degree to which these forestry practices are included in the Agricultural Conservation Program for any state, and the degree to which these practices are applied on the ground, is usually in direct proportion to the degree the local forest agencies, the state extension forester, and the state Agricultural Conservation Committee recommend that they be included and utilized.

4. *The Soil Conservation District Law.*—The federal government, in 1935, passed

a Soil Conservation Law which provides that the federal government may assist states which have satisfactory soil conservation laws. Such state laws usually provide that soil conservation districts can be established through vote of a majority of the residents of the district concerned. I might mention that such state enabling acts already have been passed by Pennsylvania, Maryland, and New Jersey. After the establishment of such soil conservation districts, the state and federal governments cooperate with the landowners in placing the lands concerned in a more productive condition. In my opinion, this tool is of tremendous importance and value, and should be considered of special value to improve forest land project areas where soil erosion control forms a major problem.

5. *Cooperative Farm Forestry Law.*—The Cooperative Farm Forestry Law, authorizing the appropriation of 2½ million dollars and passed last session by Congress, was recently referred to by a U. S. Senator from one of our southern states as the most constructive piece of legislation passed by the last session of Congress. As you know, no funds have as yet been made available but it is hoped and expected that funds will be made available under this law starting with next fiscal year to both the federal Extension Service for transfer to state extension services, and to the federal Forest Service for transfer to state forest services. When made available under this Act, the funds may be utilized for informational, educational, and demonstrational farm forestry activities, for the establishment of tree nurseries, for the surveying and improving of farm woodlands, and for assisting farm woodland owners in the marketing of their wood products. This is a cooperative project which I feel will present the most effective tool to solve our farm woodland problem yet to be placed at our disposal.

6. *Cooperative sustained yield projects.*—Demonstration cooperative sustained yield projects on commercial timberland and farm woodland have been initiated during the past two years in a number of states. Usually the first step to utilize this tool is a recommendation by a forest landowner or a state agency that a preliminary survey be made of an area to determine the practicability of utilizing this tool to improve the forest land of, and income from, the area concerned. The second step is usually to determine the preliminary boundaries of the area, the method by which the preliminary survey should be accomplished, and the persons or agencies to handle this preliminary job. The third step is a conference by all interested agencies to review the findings of the preliminary survey and to determine the practicability, desirability, and program of further cooperative action, to initiate the sustained yield project. Usually the first job to be done in connection with the actual establishment of the sustained yield project is to cover the selected area with an intensive timber survey and growth study to furnish an accurate cutting or management plan for use by the landowners and local forest agencies. Following this survey and management plan, an association of landowners may be formed to ascertain and obtain the best markets for wood products from the area, and to assist in obtaining advice as to proper handling of each owner's timberland so that products of maximum value may be produced on a permanent basis with maximum benefit to the land owners, the wood-using industries, and the community.

You might be interested in learning that this tool has been utilized in Coos County, N. H., and in Essex County, Vt., where over 135,000 acres of farm woodland have been surveyed through the cooperative efforts of the extension and forest services of these states, and the federal Forest Service. A cooperative marketing association of landowners has been formed which

uring this winter, is supplying local pulp hills with over 30,000 cords of pulpwood. n Tioga County, N. Y., in cooperation vith the Soil Conservation Service and he state extension service, we have sur-veyed 30,000 acres of farm woodland, and he extension service is now assisting the ocal landowners to form a cooperative marketing association, while the local lum-ber mill owner has offered a premium to he association for all wood products sold o his mill from the land handled under sustained yield management. Likewise in West Virginia, in cooperation with the College of Agriculture of West Virginia University and the state Forest Service, the federal Forest Service is planning to survey approximately 40,000 acres of woodlands, and a cooperative marketing association has been formed by the local forest landowners, while the local pulp-wood company has paid a bonus for pulp-wood sold to it through the association, in recognition of the value it feels such an association will be to the company. A similar project in Pennsylvania, where a local mill owner has offered a similar bonus, was inspected last summer by a representative of the federal Forest Service, and the results of this preliminary survey have been presented to representatives of the state forest service and state extension service for determination as to their wish to proceed further with this project. A similar project area has been investigated during the past month in Virginia in cooperation with the Virginia State Forest Service and the extension service, while a similar preliminary survey is being made this month in Maryland with the federal Forest Service cooperating with the state forest service and extension service.

Time does not permit me to describe the many possible applications of this tool to fit varying conditions, but I would like to emphasize that utilization of this tool can be fashioned to fit the individual area or problem, and its use should be equally beneficial to the landowner, the wood-using industry owner, the forest community, and the forest agencies.

I have tried to point out the major forest land problem of this section, the three possible avenues through which we might attack and solve this problem, and the six tools recently made available or soon to be available, one or more of which might be utilized to solve the forest land problem in any particular area under the cooperative approach. The problem and the tools to solve the problem are presented. It is probable that a single individual cannot apply the selected tool himself, but you can exert your influence to have the forest landowner, the wood-using industry owner, or the forest agency you work with, either handle the job or cooperate with other landowners or agencies in applying the proper tool or tools. The challenge is offered to each of us. May I emphasize, however, that to succeed in cooperative programs and projects requires definite contributions in time and effort from *each* cooperator. The federal Forest Service is anxious to cooperate in every possible way, but I feel the responsibility for initiating action within each project area or state lies primarily with the forest landowners, and the local and state forest agencies of that area and state.

THE HISTORY OF SHIPMAST LOCUST

By ORAN RABER
U. S. Forest Service

The introduction of the shipmast locust to Long Island from Virginia has been quite generally credited to a Captain John Sands. Dr. Raber has made a detailed study of the historical evidence for this belief and concludes that the origin of the shipmast locust is obscure and that when and by whom it was introduced to Long Island is unknown.

THE superiority of shipmast locust (*Robinia pseudoacacia* var. *rectissima* Raber) over the ordinary black locust as a source of fence posts has been indicated by Hirt (4), Raber (7), and other workers interested in the use of shipmast locust. That this variety is a distinctly superior one is now becoming commonly recognized, thanks especially to the studies being carried out by the Soil Conservation Service under the leadership of S. B. Detwiler. As a result, this plant, which is now being extensively grown for erosion-control purposes in many sections of the United States, gives promise of being extremely widespread within a few years; and for this reason, any facts that will shed light upon its history are of especial interest to students of plant origins and development. In a recent article, Detwiler (1) discusses the early history of the plant on Long Island, where it was first observed, and seems to credit the legend that a Captain John Sands (1649-1712) brought the shipmast locust to Long Island from Virginia. When the present writer was making his early studies on the morphology and general characteristics of shipmast locust on Long Island, however, he also investigated the source of these legends; and it is his conclusion that the connection of the shipmast locust with Capt. Sands is only a tradition and a none-too-well authenticated one at that.

As stated correctly by Detwiler, who, it should be emphasized, is more responsible than anyone else for the interest taken in shipmast locust and for its scientific study, the first mention of Capt. John Sands in connection with this variety of black locust was made by John Hicks (3) of Roslyn, Long Island, in an address before the American Forestry Congress in Cincinnati, April 1882. Mr. Hicks, however, does not state the source of his information. True, Capt. Sands was an early settler on the Island; true it also seems to be that the first shipmast locusts were planted on Long Island about the time Capt. Sands was living there; and true it also is that Capt. Sands is buried in the middle of a grove of shipmast locusts. But that he ever had anything to do with the introduction of shipmast locust to Long Island is a very different matter.

Traditions of this sort have a well-known way of starting. At the outset, someone *guesses* that a certain event may have occurred. Later on it is reported as a matter of high *probability*, and shortly the event becomes a locally accepted "*fact*." Furthermore, men who are accustomed to checking up very carefully on ordinary statements will frequently pass over very obvious slips in tradition if this tradition happens to support some favorite hypothesis. Thus Henry Hicks, who is a firm believer in the Sands legend and has had much to do with its perpetuation, in a letter to S. B. Detwiler (January 5, 1934) says: "There is a book ***** by Henry Onderdonk, Jr., which mentions Captain Sands as a Revolutionary officer. We have a copy of it." Now it is obvious that if Capt. Sands brought the shipmast

locust to Long Island about 1700, he could not have been a Revolutionary officer, and that the Capt. Sands referred to must have been another Capt. Sands.

The Capt. John Sands referred to was the son of Capt. James Sands, who in 1660 with 15 other persons purchased Block Island (between Martha's Vineyard and Long Island), where he became a prominent man and one of the leaders in local affairs. John Sands was born on Block Island in 1649, but in 1691, owing to the repeated attacks by French privateers upon their Block Island home—attacks in which the Sands family suffered severely—he removed to Long Island, where he died in 1712.

Detwiler quotes from Benjamin F. Thompson's "History of Long Island" (9), where Mr. Thompson asserts (Vol. 4, p. 391) as a definite fact that John Sands brought from Virginia to Sands Point, Long Island, some young locust trees, which later grew and produced all of the valuable timber of that kind in the town and neighborhood. In this connection, it should be noted, however, that this history of Long Island was published in 1918, or thirty-five years after the Sands story first appeared in print (in the article by John Hicks); and while quoting Thompson it is only fair to quote also what he has said in Vol. 3, pp. 192-193, wherein it is stated that:

"A large tract on the lower part of the Neck [Cow Neck and now known as Manhasset Neck] became afterwards the property of the Cornell family, who in 1695 or 1696, sold the northern portion of it to Captain John Sands, and his brothers James and Samuel, who removed from New Shoreham, or Block Island, and entered into possession of said lands, from which period the northern part of the Neck has been known by the appellation of "Sands Point." James subsequently resided at Matinecock in the adjoining town, for it was during his continuance there that on the 14th of March, 1710, he released his interest in Block Island to his brother John, who it appears continued his maritime pursuits, making frequent and profitable voyages between New York and Virginia. And it was on one of these occasions, it has been alleged, that he brought to Cow Neck a number of young locust trees, which he caused to be planted on both sides of the cove near which his brothers resided, from which trees thus set out, it is believed, we are indebted for most, if not all, the trees of this valuable timber, now growing on the north side of the Island. It is extensively cultivated between Flushing and Smithtown, being literally a mine of wealth to prospective owners. Fences are here mostly constructed of it, and almost every farmer has now his forest of locust, of from 10 to 100 acres in extent."

It will be noted in the above quotation that Thompson is here not nearly so certain about the Sands story and uses the term "it has been alleged" and later "it is believed."

This tradition is also referred to in Martha Flint's "Early Long Island History" (2) where one reads (page 29):

"Many a comfortable old farm house is shingled to the ground with cedar shingles bleached by the storms of a hundred winters, and shaded perhaps by the very locusts which Captain John Sands*** first brought from Virginia to Long Island on a return voyage of his coasting schooner full two centuries ago. Such a one stands in the grounds of Mr. George W. Cox at Glen Cove."

The story, as told to the writer by Henry Hicks, is that on one of his trips along the Virginia coast, where Capt. Sands was probably engaged in the slave and tobacco trades, there arose a severe storm in which either a mast or boom on the ship broke. Capt. Sands went ashore to replace it and by chance hit upon a locust, a wood much appreciated in Virginia even then. Impressed by the merits of this wood, on a subsequent trip to the

South he brought back with him to Long Island the sprouts of the trees from which all the present shipmast locusts have been propagated.

Strange to say, however, this story does not occur in the Sands genealogy by Temple Prime (6), even though it was published in 1886, only 3 years after the story was first mentioned by John Hicks. In fact, little is told of Mr. John Sands and were it not for "Niles Narrative" (p. 28-33) we should not even know that he was a captain by profession. Here, however, we learn merely a few incidents about "Captain John Sands, a gentleman of great port and superior powers*** a benefactor to the poor*** a promoter of religion*** inclined to the Anabaptist persuasion." Also it may be mentioned that in this genealogy a severe storm off Long Island is described, but none off the Virginia Coast; *nor is any mention made of the importation of the shipmast locust.*

It seems strange that if Capt. John Sands had been the benefactor to Long Island that this tradition claims him to have been, his historian did not mention it. Inasmuch as what one does *not* say is of almost as much importance in historical research as what one *does* say, it is thus highly significant that this only biographer of Capt. Sands does not mention that he brought back to Long Island a tree so valuable as the shipmast locust, if this story was current in 1886.

It is even very doubtful whether John Hicks in the article cited above, in which he casually says "there are locust trees*** at Roslyn, L. I., that were brought by Capt. Sands from Virginia over a hundred years ago," intended to credit Capt. Sands with the introduction of the shipmast locust to Long Island. This is indicated by the fact that (1) he mentions Capt. Sands without specifically stating that he brought the locusts *originally* into Long Island; (2) he seems to be stressing the point that *some* locust trees on the island came from Virginia, obviously unaware that *all* the trees of the Long Island yellow locust (i. e., shipmast locust) came originally from there; and (3) he uses the phrase "over 100 years ago" when "nearly 200 years ago" would have been much more apropos if he had intended to credit our Capt. John Sands with the original introduction. A careful perusal of that paragraph, therefore, should cast considerable doubt on the theory that John S. Hicks in 1882 knew aught of the story that Capt. John Sands was supposed to be the original importer of shipmast locust to Long Island.

Henry Onderdonk, Jr., in his "Historical Sketch of Ancient Agriculture, Stock Breeding, & Manufacturers in Hempstead" (5) says (page 59): "A Virginia trader is said to have planted the first locust at Sands' Point, whence it has spread over the Island." Does it not seem a bit strange that he should mention Sands' Point and not associate the locust with Capt. Sands or anybody by that name, if at that time (1867) the locust was connected with the name of Sands?

Also it should be noted, Peter Ross in his History of Long Island (8) says (page 6) in speaking of the vegetation of the Island:

"The most prolific of these trees was the locust, which was first planted at Sands' Point about 1700 by Captain John *Smith* [italics of O. R.] who brought the pioneer specimens from Virginia. It spread with great rapidity and the quality of the lumber was regarded as better than that in the trees it left behind in its parent state. Nowhere else on the Atlantic Coast does the locust flourish as on Long Island."

Thus we see that in general the earlier works either did not pretend to say who brought the locust to Long Island or else did not agree on any one man, but said "a Virginia trader," "Captain John Smith," etc. Not until 1896 do we find the first *unquestionable* association of the *original importation* of the shipmast locust with

Capt. John Sands. According to the generally accepted principles of historical research, the earlier documents should be given preference unless later documents are based upon some original ones more recently discovered. Since no such discoveries seem to have been made, since it is also accepted that what has not been said is often of as much importance as what has been said by a historian, and since the shipmast locusts have been associated with Capt. Sands chiefly in the last 40 years, we must conclude that before attributing their importation to him we should give the matter very careful study. Some might say that Ross' "Captain John Smith" was merely a *lapsis plumae*, but the Smith family on Long Island is a very ancient and important one.

If we cannot accredit Capt. John Sands with this importation, can we accredit anyone? The answer here is also doubtful. It is a matter of common knowledge that in regions close to the ocean anything new and strange is very often attributed to the prowess of some ocean traveler or to some unknown sea captain. Very often ship captains have brought home exotic plants and animals collected in their travels; and thus the idea arises that every strange and uncommon plant must have been imported by some such wanderer. In June 1934, I found a shipmast locust in a house yard about a mile north of Sagamore, Mass. In the same yard was a huge honey locust. The present occupant of the house had not considered the shipmast locust as especially noteworthy, but when I mentioned the fine honey locust, which at that time was over 3 feet in diameter at breast height, she said, "Yes, that was brought here, according to the story, by an old sea captain from the South."

Thus, that the shipmast locust was brought to Long Island by Capt. John Sands must, therefore, for the present, be considered extremely doubtful. Although everything points to the fact that this plant is not endemic to Long Island, until it is located at some distant point and its provenance and native habitat ascertained, the question of its origin is open to final solution. Possibly it did originate in Virginia, but it has not yet been found there; and until it has been found there or in some other distant spot, its origin must remain obscure if not entirely unknown.

Literature Cited

1. Detwiler, S. B. 1937. The history of shipmast locust. Jour. For. 35:709-712.
2. Flint, M. B. 1896. Early Long Island history. G. P. Putnam's Sons.
3. Hicks, John S. 1883. The black or yellow locust. Amer. Jour. For. 465-469.
4. Hirt, R. R. 1938. A progress report on laboratory tests of the relative durability of different varieties of black locust subjected to certain wood decay fungi. Jour. For. 36:53-55.
5. Onderdonk, H., Jr. 1867. Historical sketch of ancient agriculture, stock breeding, and manufactures in Hempstead. Jamaica, L. I.
6. Prime, T. 1st ed. 1886. Descent of Comfort Sands and of his children. New York City. (2nd ed. 1897.)
7. Raber, O. 1936. Shipmast locust—a valuable undescribed variety of *Robinia pseudoacacia*, U. S. Dept. Agr. Circ. 379.
8. Ross, P. 1902. History of Long Island. Lewis Pub. Co.
9. Thompson, B. F. 1918. History of Long Island. 4 vols. Robt. H. Dodd Pub. Co.

RELATIVE DURABILITY OF BLACK LOCUST AND SHIPMAST LOCUST WHEN SUBJECTED TO FOUR WOOD DECAY FUNGI

By E. RICHARD TOOLE
Duke School of Forestry

The wood of shipmast locust long has been considered more durable in actual service than that of the common black locust. The results of certain laboratory tests have been interpreted to indicate a similar relationship. The laboratory data now have been subjected to an analysis of variance. This analysis shows that of the four fungi studied the difference in durability between common black locust wood and shipmast locust wood is significant only in the case of *Poria incrassata* and in the case of *Fomes rimosus*.

IN a recent issue of the JOURNAL[1] an interesting laboratory experiment on the relative durability of different varieties of black locust subjected to certain wood decay fungi was reported. Although certain differences in the amount of decay are plainly evident, yet, a complete interpretation of the data presented was not made.

In order to obtain an estimate of the importance of these differences the data (summarized in Table 1) have been subjected to analyses of variance.[2] Table 2 shows the results.

The experiment was so designed that tests of the significance of differences between the effect of different fungi within each variety should be based upon mean square "between cultures of the same fungus".[3] This follows from the fact that a "culture" is a single fungus only. Tests of the relative durability of the two varieties subjected to the same fungus, however, should be based upon mean square "between blocks of the same culture", since blocks of both varieties were introduced into each culture. On the other hand, regardless of the experimental design, the variances of the two varieties are analyzed separately because the mean squares which supply the black locust experimental errors are very much greater than those of shipmast locust. Consequently they are not pooled into a single analysis.

The comparisons of the mean squares "between fungi" with those for "between cultures of the same fungus" in the case of both varieties of locust show that the probability that the difference in the mean square due to chance alone is less than one in one hundred ($P < .01$). In other words there are definite differences in activity among the fungi within the same variety, above and beyond differences due to experimental error.

Differences between the observed sums according to fungus for black locust which exceed 3.833 grams and 5.288 grams are significant of real effects at the 5 per cent and 1 per cent levels, respectively. These numerical values are arrived at by multiplying the standard error of the difference between 2 sums of 5 culture observations by the t (see Snedecor[4]) value appropriate to 16 degrees of freedom at those levels of significance. On this basis the difference between *Polyporus*

[1] Hirt, R. R. A progress report on laboratory tests of the relative durability of different varieties of black locust subjected to certain wood decay fungi. Jour. For. 36: 53-55, 1938.

[2] Fisher, R. A. Statistical methods for research workers. Oliver and Boyd, London. 1936.

[3] Terms in quotations refer to terms used in Table 2.

[4] Snedecor, G. W. Calculation and interpretation of analysis of variance and covariance. Collegiate Press, Ames, Iowa, 1934.

TABLE 1[1]

LOSS OF WEIGHT IN GRAMS IN COMPARATIVE TESTS ON HEARTWOOD BLOCKS OF COMMON BLACK LOCUST AND OF SHIPMAST LOCUST SUBJECTED TO DECAY BY FOUR DIFFERENT FUNGI FOR A PERIOD OF FIVE MONTHS[1]

Fungus	Culture[2] number	Black locust	Shipmast locust
Polyporus	1	.210	.00
robiniophilus		.605	.00
	2	.638	.00
		.150	.00
	3	.539	.00
		.035	.00
	4	.262	.15
		.790	.00
	5	.505	.00
		.630	.00
	Sum	4.364	.15
Fomes	1	.279	.00
igniarus		.119	.00
	2	.116	.04
		.070	.04
	3	.620	.00
		.095	.00
	4	.140	.00
		.260	.00
	5	.440	.00
		.220	.00
	Sum	2.359	.08
Poria	1	4.790	.230
incrassata		2.356	.350
	2	4.410	.560
		4.420	.235
	3	4.326	.165
		1.860	.178
	4	2.785	.110
		4.240	.350
	5	4.080	.098
		2.658	.340
	Sum	35.925	2.616
Fomes	1	1.140	.00
rimosus		.817	.00
	2	1.709	.03
		.639	.03
	3	.470	.00
		1.040	.00
	4	.214	.03
		1.960	.00
	5	1.130	.01
		.040	.00
	Sum	9.159	.10

[1]These data were taken from Table 1, p. 54, Jan. 1938 issue Jour. For.

[2]Each culture contains four blocks, 2 of each variety.

robiniophilus (Murr.) Lloyd and *Fomes rimosus* (Berk.) Cooke is significant at the 5 per cent level; the differences between *Poria incrassata* (Berk. and Curt.) Burt. and the other three fungi are significant at the 1 per cent level; and the difference between *Fomes rimosus* and *Fomus igniarius* (L.) Gill. is significant at the 5 per cent level. Similarly in the case of shipmast locust, differences which exceed .643 grams and .885 grams are significant at the 5 and 1 per cent levels respectively. Then it is seen from Table 1 that the difference between *Poria incrassata* and the other three fungi are significant at the 1 per cent level, while the differences among the other fungi are not sufficient to be termed significant.

The comparison of the "between blocks in the same culture" mean squares for each of the two varieties of locust demonstrates that the differences between the amount of decay between the two varieties are significant at the 1 per cent level. Differences between the observed sums between the two varieties for each fungus which exceed 4.901 grams and 6.557 grams are significant at the 5 per cent and 1 per cent levels, respectively. These values are obtained by multiplying the standard error of the difference between 2 sums of 5 culture observations by the t value appropriate to 40 degrees of freedom at those levels of significance. The differences in amount of decay between both *P. incrassata* and *F. rimosus* on the two varieties of locust are significant at the 1 per cent level while those differences between both *P. robiniophilus* and *F. igniarius* on the two varieties of locust are not significant at either the 5 per cent or 1 per cent levels.

Considering an absence of decay or the control, to be an absolute zero, it cannot be shown whether the probability that the departure from zero caused by decay is due to chance in an amount $<$ or $>$ .05.

From these data it is shown that of the four fungi studied, the difference in durability between black locust wood and shipmast locust wood is significant only in the case of *P. incrassata* and *F. rimosus,* since the probability that these differences are due to chance is less than one in one hundred. It cannot be show from this experiment that the differenc between *P. robiniophilus* and *F. igniari* on the two varieties of locust are signi cant, since the probability that these di ferences are due to chance is greater tha five in one hundred.

TABLE 2

ANALYSIS OF VARIANCE FOR LOSS OF WEIGHT MEASUREMENTS FOR EACH VARIETY

Source of variation	Degrees of freedom	Sum of squares	Mean square	F[1]	P[2]
Black locust					
Between fungi	3	72.811097	24.270366	147.673	< .
Between cultures of same fungus	16	2.629627	.164352		
Total between cultures	19	75.440724	3.970564		
Between blocks of same culture	20	11.632100	.581605	89.533	< .
Total	39	87.072824			
Shipmast locust					
Between fungi	3	.471263	.157088	34.299	< .
Between cultures of same fungus	16	.073273	.004580		
Total between cultures	19	.544536	.028660		
Between blocks of same culture	20	.129929	.006496		
Total	39	.674465			

[1]F = Comparison of ratio of larger Mean square to the smaller. Example: $\frac{.581605}{.006496} = 89.5$

[2]P = Probability that this ratio is greater than (>) or less than (<) one out of a hun dred chances obtained by comparing the F value obtained with corresponding values in G. W Snedecor's table of F.

Approximately 65,000 miles of roads and nearly 130,000 miles of trails on the 157 National Forests were maintained in 1937 by the U. S. Forest Service. The total road mileage maintained included 1,793 miles of forest highways and 63,564 miles of truck trails.

Construction was completed on 3,747 miles of National Forest roads and on 1,403 miles of horse and foot trails. The road construction included 265 miles of forest highways and 3,482 miles of truck trails.

METHODS OF STRATIFICATION FOR LOBLOLLY PINE SEEDS

By A. L. MacKINNEY and W. E. McQUILKIN
Appalachian Forest Experiment Station

Loblolly pine seeds were stratified in a number of different media at different moisture contents for various periods of time. A detailed study was made of the viability and the promptness of germination of the seeds so stratified, and some interesting and important relationships were determined. For practical purposes it is recommended that before sowing, loblolly pine seeds be stratified two to three months in thoroughly moistened sand or peat at temperatures between 32 and 40° F.

THE germination of the untreated seeds of loblolly pine (*Pinus taeda* L.), in common with that of many other tree species, usually is characterized by delay, irregularity, and actual failure of some live seeds to sprout. This is true both of freshly collected and of old seed (3). Complete, prompt, and uniform germination obviously is desirable in the nursery from the standpoint of both quality and cost of stock. Hence, a considerable number of investigations have been directed toward devising and perfecting presowing treatments for seed to induce more satisfactory germination.

The most generally practicable and effective method thus far discovered is stratification of the seeds for several weeks or months at relatively low temperatures in a porous, well moistened medium such as sand or peat. Barton (1, 2), working with the seed of more than thirty different conifers, found that germination was somewhat hastened in practically all of the tested species, and that in the majority of them the final percentage of seedling production was increased by the stratification treatment. Stratification in moist acid peat was effective for most species, including loblolly pine, within fairly wide limits of time and temperature. Good results were obtained at temperatures ranging from 0° to 15° C., (32° to 59° F.) and with durations of treatment of from 1 to 4 months. For practical purposes, stratification for 2 months at 5° C. (41° F.) was recommended.

The present investigation was designed to obtain additional information on the best methods of over-winter storage as a presowing treatment for loblolly pine seeds to be used in southern nurseries. It supplements Barton's work by testing the efficacy of other stratification media and different moisture contents of media. The possibility of substituting the conditions prevailing within a cool, moist spring house for the oftentimes less readily accessible conditions of an ice house or cold storage chamber was also investigated.

The study comprised two experiments. Experiment I was a comparison of the merits of different stratification materials and conditions, *viz.*, dry sand, moist sand, dry peat, moist peat, and no medium (control), all of which were tested in an ice house and in a spring house. Experiment II was an outgrowth of the first; it tested the effects of different amounts of water in peat and in sand in a controlled temperature chamber held at 34° to 38° F.

Procedure

The work here reported extended through parts of two years. Experiment I extended from January through June in 1933, Experiment II through the same months in 1934. Fresh seed was used in each experiment. After extraction from the cones by solar drying, which required about seven weeks, the seed was cleaned and placed in dry cold storage for approximately one month prior to the begin-

ning of the respective experiments. The two lots of seed are described in Table 1.

In both experiments, the lots of seed were divided into 200-seed samples and placed in separate small cloth bags. These were buried in the stratification media in wooden boxes about 12x24x6 inches deep. At approximately monthly intervals for three months one sample was removed from each treatment medium for tests of viability and promptness of germination. All tests were made in flats in a greenhouse where the temperatures ranged, with fairly regular fluctuations, from 50° to 80° F., averaging about 65°. The seeds, in rows of 20, were planted at a depth of approximately one-fourth inch in a mixture composed of one-half sand and one-half woods soil. Germination counts were made for Experiment I every 2 days, and for Experiment II every 3 days. After each examination the counted seedlings were removed. Germination was considered completed when no more seedlings appeared in a given sample for 8 days (Experiment I) or 9 days (Experiment II). Different units of time were employed in the two experiments merely because of convenience.

Experiment I.—In the first and more exploratory of the experiments, ordinary river sand and florist's peat, both wet and dry, were compared as stratification media in two places differing primarily in temperature. A commercial ice house, and a spring house during the winter and spring months, were used. Control samples of seeds without medium were subjected to each external environment in dry, open, 2-quart glass jars.

The "dry" media were air-dry and the "wet" were saturated for 6 hours followed by 1 hour of draining. The media in the ice house were rewetted once each month and those in the spring house twice monthly, to a point where water could be squeezed from the material.

The temperatures in the ice house ranged from 34° to 39° F., averaging about 36° for the period of the experiment. Temperatures in the spring house fluctuated more widely, because of variations in outside air temperatures. During January and February the range was from 42° to 55° F., averaging about 50°. The averages for March, April, and May approximated 55°, 60°, and 63°, respectively.

Experiment II.—This experiment was designed to compare the effects on seed germination of different moisture contents of stratification media. Washed sand and florist's peat, previously oven-dried, were each used with moisture contents of 25, 50, 75, and 100 per cent of water holding capacity. The moisture contents of the media were held practically constant throughout the treatment period by checking the gross weights of the stratification boxes at approximately weekly intervals and, if necessary, adding water to replace losses from evaporation. All stratified samples were kept in a controlled temperature chamber at 34° to 38° F. for the duration of the treatments.

Results

The results of Experiment I are summarized in Table 2. It is evident that both wetness of stratification medium and length of stratification period, in both

Table 1

SUMMARIZED DESCRIPTION OF SEEDS USED IN EXPERIMENTS

	Experiment I	Experiment II
Time of collection	Autumn, 1932	Autumn, 1933
Place of collection	Pender County, N. C.	Bertie County, N. C.
Method of cleaning	By blower	By flotation
No. clean seed per pound	17250±592[1]	17540±768[1]
Viability by cutting test	77.4±13 per cent[1]	98.5±2 per cent[1]

[1]Standard deviation.

the external environments, had significant effect on the length of the germination period. Since these results are so plainly evident, the analysis of variance (4) is not included. No consistent differences between peat and sand as stratification materials were found in the experiment.

The length of the germination period decreased with all treatments, including the controls, as the length of treatment period increased. The decrease was essentially uniform for all dry conditions in both ice house and spring house. Stratification in dry media thus had no effect which was not equally evident in the unstratified controls. This uniformity of the behavior of samples from all dry conditions indicates that, during the months immediately following collection, the seeds normally undergo changes by which their germinability is to some degree improved. Hence, any improvements in germination appearing after treatment represent the effects of that treatment combined with the independent effects of time, and consequently, the effects of different treatments are most validly compared when the time factor is the same.

Moist stratification in both ice house and spring house, as compared to dry treatments for the same periods, resulted in a marked hastening of germination. This effect was clearly evident in samples tested after only 28 days of treatment; after 56 and 84 days, samples from moist media completed germination in 50 to 60 per cent of the time required by the dry-treated seeds. The changes induced by moist stratification progressed more rapidly in the spring house than in the ice house. Samples removed from the moist media after 56 days in the spring house completed germination in practically the same time as did samples which had been in the ice house for 84 days, and 84 days of moist stratification in the spring house resulted in greater shortening of the germination period than did any other treatment. The changes which take place in the seeds evidently are accelerated by higher temperatures and possibly, also, by fluctuations in temperature such as occurred in the spring house.

The influence of the various treatments was much less pronounced on the total percentage, than on the rate, of germination. The only indication of a definite effect on percentage of germination was the decrease after 84 days in the spring house. Apparently a decline in vitality is induced by higher temperatures when continued 3 months or more. This inference was substantiated by a simple supplementary experiment in which loblolly pine seeds, after moist stratification in the spring house for one year, showed less than 30 per cent germination. In view of these results, it appears inadvisable to substitute the merely cool conditions of a spring house for the somewhat lower temperatures usually recommended, particularly when the stratification period is to be prolonged. With higher temperatures, it becomes increasingly necessary that the length of the treatment period be accurately pre-determined and rigidly observed.

TABLE 2

RESULTS OF DIFFERENT TREATMENTS OF LOBLOLLY PINE SEED, EXPRESSED IN NUMBER OF DAYS REQUIRED FOR GERMINATION TO BE COMPLETED AND PERCENTAGES OF GERMINATION

Stratification medium	After 28 days' treatment				After 56 days' treatment				After 84 days' treatment			
	Ice house		Spring house		Ice house		Spring house		Ice house		Spring house	
	No. days	Per cent germ.	No. days	Per cent germ.	No. days	Per cent germ.	No. days	Per cent germ.	No. days	Per cent germ.	No. days	Per cent germ.
Moist peat	60	65.5	74	71.0	44	72.0	30	73.5	32	74.5	28	68.5
Moist sand	68	71.5	80	73.5	40	70.5	30	70.0	28	71.5	22	68.5
Dry peat	90	66.0	92	72.5	72	66.0	72	73.0	50	67.0	48	68.5
Dry sand	90	65.5	92	69.0	70	71.0	70	69.0	54	71.5	54	65.0
None (open jar)	90	70.5	90	72.0	72	69.0	70	71.0	54	69.0	54	68.0

The results of Experiment II are shown in Table 3, and the analysis of variance with respect to length of germination period and percentage of germination is given in Table 4. The results in both respects show "time," i. e., the length of the stratification period, to be the only significant factor. This is conclusively shown, as regards length of germination period, by the magnitude of the corresponding figure (122.76) in the first "F" column of the analysis table. By reference to the data in Table 3, the average length of the germination period after 90 days' treatment is found to be 20 days, as compared to 43 days after 60 days' treatment, and 53 days after 30 days' treatment. The effect of "time" on percentage of germination is less conclusively demonstrated. The relatively small value (7.37) in the second "F" column of Table 4 shows that the apparent time effect might once out of 20 times be due to chance alone.

As in Experiment I, peat and sand proved to be practically equally effective as stratification media. The water content of medium, which was the primary factor here under test, exerted no significant effect over the entire range covered by the experiment. Experiment I showed that some degree of wetness of medium is necessary if stratification is to be effective. Experiment II, though it does not establish the minimum effective water content of medium, indicates that the essential requirement is merely wetness, rather than any specific degree thereof. A water content of 25 per cent is neither more nor less effective than greater amounts. It is noteworthy that wetness to the full capacity of the medium produced no ill effects. Apparently it is impossible to provide too much water, at least so long as the seeds are not actually submerged.

TABLE 3

RESULTS OF STRATIFICATION OF LOBLOLLY PINE SEED IN MEDIA OF DIFFERENT WATER CONTENTS, EXPRESSED IN NUMBER OF DAYS REQUIRED FOR GERMINATION TO BE COMPLETED AND PERCENTAGES OF GERMINATION

Water content of media as per cent of water-holding capacity	After 30 days' treatment				After 60 days' treatment				After 90 days' treatment			
	Peat		Sand		Peat		Sand		Peat		Sand	
	No. days	Percent germ.	No. days	Percent germ.	No. days	Percent germ.	No. days	Percent germ.	No. days	Percent germ.	No. days	Percent germ.
25 per cent	45	95.0	54	95.5	33	93.5	42	89.0	18	96.5	21	95.5
50 per cent	48	91.0	57	93.0	42	92.0	42	92.0	21	95.0	18	92.5
75 per cent	54	91.0	57	91.0	45	90.0	54	93.0	21	97.5	21	97.0
100 per cent	54	92.0	57	93.5	48	93.0	39	94.5	18	91.5	24	96.0

TABLE 4

THE ANALYSIS OF VARIANCE FOR EXPERIMENT II, SHOWING THE SIGNIFICANCE OF THE EFFECTS OF THE VARIED FACTORS ON LENGTH OF GERMINATION PERIOD AND ON PERCENTAGE OF GERMINATION

Sources of variation	Degrees of freedom	Length of germination period			Per cent of germination		
		Sum of squares	Mean squares	F[1]	Sum of squares	Mean squares	F[1]
Moisture	3	139.125	46.375	2.49	7.615	2.538	0.[illegible]
Medium	1	63.375	63.375	3.40	0.844	0.844	0.[illegible]
Time	2	4572.750	2286.375	122.76	41.896	20.948	7.[illegible]
Interactions							
Moisture-medium	3	40.125	13.375	0.72	13.781	4.594	1.[illegible]
Moisture-time	6	62.250	10.375	0.56	37.854	6.309	2.[illegible]
Medium-time	2	23.250	11.625	0.62	1.188	0.594	0.[illegible]
Remainder (error)	6	111.750	18.625		17.062	2.844	

[1]Individual mean squares expressed as multiples of remainder mean square.

Summary

1. An investigation was made of the comparative efficacy of different materials and media, moisture contents of media, periods of treatment, and temperatures for the stratification of loblolly pine seeds as a means of inducing prompter and more complete germination.

2. The stratification medium must be thoroughly moist in order to be effective in hastening germination and in promoting complete germination. Dry stratification is neither more nor less effective than is exposure of the seeds in an open jar to the same temperatures for the same periods of time, without benefit of stratification media.

3. The amount of water in the stratification medium is immaterial as long as it approximates or exceeds 25 per cent of the water-holding capacity.

4. Peat and sand are equally effective as stratification media.

5. The changes induced in the seeds by stratification treatments proceed more rapidly under the higher temperatures which prevail in a spring house than under the lower temperatures of an ice house. Treatment for 56 days in a spring house at temperatures averaging about 50° F. was essentially equivalent to treatment for 84 days in an ice house at an average temperature of 36° F.

6. Moist stratification under the relatively high temperatures of a spring house results in decreased vitality of seeds when continued for three months or more.

7. For practical purposes, it is recommended that, before sowing, loblolly pine seeds be stratified for 2 to 3 months in thoroughly moistened sand or peat at temperatures between 32° and 40° F.

Literature Cited

1. Barton, Lela V. 1928. Hastening the germination of southern pine seeds. Jour. For. 26:774-785.
2. ————. 1930. Hastening the germination of some coniferous seeds. Amer. Jour. Bot. 17:88-115.
3. ————. 1935. Storage of some coniferous seeds. Contrib. Boyce Thompson Inst. 7:379-404.
4. Fisher, R. A. 1936. Statistical methods for research workers. 6th Ed. 339 pp. Edinburgh and London.

Big Game in National Forests Increase

BIG game animals—deer, bear, moose, antelope, elk, buffalo, mountain sheep, and mountain goats—have doubled in number on National Forests in the past 12 years, reports the U. S. Forest Service.

When the first big game census was taken in 1924 there were less than 700,000 animals. By 1930 the figure had grown to 1,000,000. Present estimates place the big game population at 1,700,000 animals. Deer have made the biggest increase and now total more than a million head.

A NEW DAY IN THE NAVAL STORES INDUSTRY[1]

By V. L. HARPER[2] and T. A. LIEFELD[3]

U. S. Forest Service

DURING the past several decades one of the oldest and most picturesque of American industries has waited with rather hopeless apprehension for its raw material to give out. But at last a new day has dawned for this unique industry. Without detracting at all from the vital part in this renascence played by wise and bold legislation, it is safe to say that without the research conducted by foresters in naval stores production since 1920, and expanded under the McSweeney-McNary Act, this new day would still be below the horizon. Instead, and as a result of this research, about 80 per cent of all the longleaf and slash pine timber currently worked for naval stores in the turpentine woods of the South is now being conservatively operated under the terms of the Agricultural Conservation Program. The chief features of the program are that no trees smaller than 9 inches in diameter are chipped, specified chipping practices are adhered to, and fire protection in cooperation with state and federal agencies is intensified.

Research into the practices of the naval stores industry in the United States has had a brief but curious history. For 300 years there was no research. Men continued to use the same crude and wasteful methods of extracting gum from the living longleaf or slash pine tree that were evolved by the early Colonial settlers in seeking pitch and tar for their wooden sailing vessels. Until about 1920 the only improvement evolved by American science—and after all it was merely borrowed from the French—was the turpentine cup which is attached to the working trees as a substitute for the old "box," or cavity skillfully cut into the base of the tree, to catch the gum which trickles down over the scarified surface above. It was this solid improvement in turpentining practice which in solving one problem created a new one. A box could not well be cut in a small tree, but a cup could be hung on a six-inch sapling. This fact the Forest Service largely overlooked in the *Capper Report* of 1920, which predicted the early death of the turpentine industry because of the depletion of the southern pine forests. The big timber in the Carolinas, Georgia, and Florida was indeed scarce, but millions of young saplings never before chipped were bled in the first ten years after the World War.

The 1920 prediction was not realized for this and two other reasons. The second was the ability of the southern pines, if given only half a chance, to grow at t prodigious rate. The third reason was research. Having provided the means for "working" immature timber, science now came to the rescue of the small tree and of the industry. Basic research at the Forest Products Laboratory at Madison, Wisconsin, on the anatomy and physiology of resin production in the pine tree showed that an unwounded pine tree contains a

[1]By naval stores industry is meant the industry that obtains its raw material from living trees. It does not include the smaller industries that produce naval stores from dead wood, such as the steam and solvent operations; or the operations that produce sulphate turpentine and rosin as a by-product of paper making.

[2]Division of Forest Management Investigations, U. S. Forest Service, Washington, D. C.

[3]Southern Forest Experiment Station.

few resin ducts in its sapwood; when wounded by the axe or hack it produces a greatly increased number in the new wood currently added through growth. Furthermore, it disclosed that a given resin duct, from which only a moderate amount of gum exudes when the tree is first chipped, after a month or so yields much more. These facts for the first time explained why the second year of turpentining, if chipping is not too heavy, produces more gum that the first, why advance preparation of a tree insures more satisfactory first-year yields, and why chipping which progresses too rapidly up the tree from the first basal streak soon gets into unstimulated and therefore less productive tissue.

Above all, the work of the Laboratory, and later of the Southern Forest Experiment Station, emphasized the need for maintaining the health and vigor of the trees if a high, sustained yield of gum is to be expected. These simple facts, confirmed by his own tests, were most effectively carried direct to the turpentine operator by the late Austin Cary of the Forest Service. Concurrently, the demonstration of improved gum handling and stilling methods carried on by the Bureau of Chemistry and Soils greatly strengthened the industry in the second major phase of naval stores production.

The improved chipping technique evolved by the naval stores research has gone far toward stabilizing the industry by making the timber last longer. Through the use of weekly streaks ½ inch in height, instead of ¾ inch or more as formerly cut, the period of turpentining each tree is considerably extended, and by reducing the depth of these streaks from 1 inch or more to ½ inch the mortality rate of the trees is greatly lowered. Dry-face, prevalent under the old methods, is largely prevented. Moreover, these new practices currently produce as much gum per tree as was produced formerly with heavy chipping.

In addition to the improved streak specifications, other studies by the Southern Forest Experiment Station have contributed much information paving the way for more efficient working of turpentine pines, increased yields, and better management of turpentine stands. It has been shown that by working one face at a time and by planning face location so as to leave no more or no less than a 4-inch strip of live wood between "front face" and "back face," gum yields are increased and, in the long run, the maximum number of faces can be placed on the tree. Defoliation of turpentined trees by fire was found to result in marked reduction in gum flow; with complete defoliation, the flow from longleaf pine was reduced 50 per cent during the first season. Recovery from fire was found to follow closely the recovery of the crown; thus defoliated trees should not be turpentined for at least one year after the damage. Intensive studies clarified the influence of air and soil temperature—particularly air temperature—on gum flow, and the varying response between longleaf and slash pines. This knowledge permits adjustment of chipping schedules to obtain maximum yields in the shortest period of time. The value of raising cups frequently to prevent the gum from flowing over a long face has been proved by improved quality of gum. Chipping with sharp hacks was found to give 15 per cent more gum than with dull hacks.

Naval-stores gum is produced by the tree at the expense of wood, and consequently some reduction in growth during the turpentining period must be expected. Studies have revealed that one face retards the tree's growth rate by 25 per cent and two faces by 40 per cent. Following the cessation of turpentining, as the face scars heal over, the growth rate may be expected to return gradually to normal, or that of an unwounded tree. At best, however, this is a slow process.

The capacity of trees to yield gum has

been related to size, growth rate, and character of limbs, etc., with the finding that diameter is by far the most significant factor influencing yield. Gum yield tables based on diameter furnish the best kind of argument against working small timber. These tables show clearly that rarely will trees smaller than nine inches yield enough gum to make a profit, and that from this diameter upward the gum yields mount rapidly. In addition it has been pointed out frequently that a large tree when abandoned for turpentining is valuable for sawlogs, piling, poles, and other uses, whereas a small worked-out tree is not only practically worthless (except for possible salvage by the paper mills that have recently come to the South), but continues to occupy the space needed for a new crop of timber.

In spite of these demonstrated advantages, the practice of waiting until trees mature fully for turpentine production has only gradually found favor with the naval stores industry. The need for immediate returns, with its attendant urge to press trees into production as soon as they can support a turpentine cup, has worked against it. In witness are the vast areas of worked-out turpentine trees of little present or prospective value for saw-logs and other high-value wood products. These trees are too small to be in demand now, and are too nearly girdled to grow at a satisfactory rate for future markets. It is partly to correct this condition that help is being given the naval stores industry through the conservation program of the Agricultural Adjustment Administration. This program requires among other things that small trees be not worked. Under this stimulus it is believed that the industry is well on its way toward a greatly needed reform.

The rather gloomy market prospects created by the inroads of substitutes make it imperative that naval stores production become efficient as never before. The fact that France on 2 million acres produces about one-fourth as much naval stores as we do on 50 million acres is a challenge to American scientists and businessmen. This country, and particularly the South, can ill afford to lose an industry which furnishes a generous proportion of jobs to the manual laborer, and in which proprietorship is rather widely dispersed because capital investments are relatively small. Greater efficiency will not only permit the payment of higher wages to more than 50,000 employees of the industry but will also increase the annual value of its products, which is now $30,000,000 to $50,000,000.

Greater efficiency in the industry demands that timber stands be built up from the present low average level of 15 workable trees per acre. A carefully planned integration of management for naval stores and other forest products must be realized. Research is ready, with a background of accumulated knowledge, to assist in these efforts. Now that it has solved the pressing problems of chipping, it is ready to turn its full attention to entirely new methods of gum extraction and to growing better stands of high-yield trees. Thus may research share in making permanent the new day in the naval stores industry.

THE EFFECT OF VEGETATION UPON SNOW COVER AND FROST PENETRATION DURING THE MARCH 1936 FLOODS

By C. H. DIEBOLD
Cornell University

Although foresters and engineers have long debated the value of forests as a means of flood control, relatively few studies have been made. The floods of March 1936 occurred during the period when the author was conducting intensive studies concerning the effect of vegetation upon snow cover and soil temperature. The data presented show that hardwood forests are a favorable influence which should be considered in flood control programs.

THE reduction of the acreage of frozen soils and the retention of snow by hardwood forests and coniferous plantations has not been considered by engineers an essential part of long-range flood control programs in the Northeast (1, 5). Nevertheless, melting snow and run-off from frozen soils were considered major causes of the March 1936 floods in the Northeast (1). These floods caused damage in excess of $100,000,000 in New England (1), and in excess of $59,000,000 in the Susquehanna watershed. However, a review of the literature shows that the relative extent of frozen soil in forest and open areas has not been systematically studied in the Northeast. The possibility of reducing the acreage of frozen soil through forest cover is of great importance. For example, there are approximately 806,000 acres of submarginal land not in woodland or brush, in the Susquehanna watershed, in New York State alone (3). In addition, there are 1,335,000 acres in forest which is composed largely of hardwoods.

The Area Investigated

This report is part of a forest influences study made at the 1,880 acre Arnot Forest,[1] which is owned by Cornell University. It is a tract of hill land located 14 miles southwest of Ithaca, New York, in the headwaters of the Susquehanna. The topography is that of a well-dissected plateau, with steep V and U-shaped valleys. The altitude ranges from approximately 1,170 feet to 1,970 feet. The prevailing humus types are root mor and twin mull, which range from one to two inches in depth. The soils have been derived from acid glacial till; gravelly silt loam textures predominate. These soils belong chiefly to the Lordstown and Volusia series and associated soils (2); they are similar to more than 5,000,000 acres in the Northern Appalachian Plateau section in New York and Pennsylvania. The experimental work was conducted in 3 hardwood types, and in adjacent cultivated and abandoned fields (poverty grass and weeds). The sugar maple-beech-yellow birch, type 12 (6), consists of closed stands of 50-to-60 year-old second growth and scattered trees of the original stand. It occurs on the northerly slopes of the major valleys, on the broad hill tops, and in the small stream valleys. The chestnut oak, type 36, is composed of an open, scrubby overstory of chestnut oak, with an irregular understory of aspen and laurel. It is confined to the south and west slopes of the major stream valleys.

[1]Some interrelationships between soil characteristics, water tables, soil temperature, and snow cover in the forest and adjacent open areas in south-central New York. Cornell Univ. unpublished thesis, Ph.D. degree, 1937. The author wishes to express his indebtedness to the Department of Forestry for the purchase of special equipment, and to Dr. J. N. Spaeth, under whose direction the study was made.

The aspen, type 4, consists of dense, even-aged, 20-to-30 year-old stands which occupy the severely burned portions of the sugar maple-beech-yellow birch sites.

Methods of Investigation

Soil temperatures were obtained at depths of 1, 5, 12 and 30 inches at weekly intervals at 20 stations throughout the winter of 1935-1936, by means of copper-constantan thermocouples,[2] and a Leeds and Northrup portable potentiometer. The potentiometer contained an automatic cold junction compensation, and was equipped with a dial reading in degrees Fahrenheit. This instrument proved to be fairly well adapted to severe conditions.[3] The combined possible error due to differences between thermocouples and to variation in potentiometer readings is about 1° F.; the majority of the readings are accurate to ¼° F. Soil temperatures were recorded at 12 forest stations and 8 adjacent open field stations which were located in three groups at the apices of a triangle, the sides of which were about 1½ miles long. The majority of these stations were established in 1934. The thermocouple data were supplemented by two Friez soil and air thermographs which were located in the sugar maple-beech-yellow birch forest (station LC), and in an adjacent open field at the Arnot Soil Conservation Experiment Station (station J1).

Snow depth data were recorded at the 20 soil temperature stations, 4 times weekly from November 7, 1935 to May 1936. The average of readings from three yardsticks, set at each soil temperature station, was recorded when the snow exceeded 5 inches in depth. When the depth of snow averaged less than 5 inches, independent readings were made by forcing the yardstick through the snow to the ground surface, averaged and recorded to the nearest half-inch.

Soil Temperatures Prior to Flood of March

A study of monthly meterological summaries for Ithaca, New York (Weather Bureau Station nearest to the Arnot F

Table 1

AVERAGE DAILY SOIL AND AIR TEMPERATURES (FAHRENHEIT), BY PERIODS, IN FOREST AND ADJACENT OPEN FIELD[1]

Bare field, exposed ridgetop, elevation 1,970 feet (station J1); sugar maple-beech-yellow birch sheltered northeast slope, elevation, 1,945 feet (station LC)

1935-1936	Average soil temperature Maximum	Average soil temperature Minimum	Average air temperature Maximum	Average air temperature Minimum	Average air temperature Daily mean[2]	Absolute minimum temperatures Soil	Absolute minimum temperatures Air
Dec. 15-Feb. 1							
Bare field	29.4	27.3	20.4	11.8	16.2	22.0	—8.0
Closed forest	32.0	31.6	20.2	12.0	16.1	31.0	—6.0
Feb. 2-Feb. 29							
Bare field	24.5	22.8	21.1	7.2	14.1	20.0	—10.0
Closed forest	31.8	31.3	21.6	9.0	14.6	30.5	—6.5
Mar. 1-Mar. 18							
Bare field	31.3	28.1	35.4	22.5	28.1	19.0	5.0
Closed forest	32.0	31.8	33.1	22.3	27.8	31.5	6.5

[1]The data were obtained by means of thermographs as follows: soil temperature at a depth of one inch; air temperature 12 inches above the ground.

[2]The daily mean air temperature (24 hours) was obtained by planimetering the thermograph records.

[2]Duplicate thermocouples were established at one inch, to insure representative readings. In the forest areas, these thermocouples were located in the humus layer.

[3]The chief disadvantage was the necessity of protecting the standard cell from temperatures below freezing. Such protection was accomplished by placing it in a woolen casing which contained a benzine pocket hand warmer.

st), shows that the air temperatures for December and February were 5° to 6° F. below normal. The winter was unusual in that the temperatures were almost continuously below 32° F. from December 15 to February 24. The average maximum, minimum and daily mean air temperatures at the bare field station were almost identical with those of the forest station (Table 1).

From November to mid-December, 1935, the soil was not frozen at any of the stations, irrespective of type of cover, except at station J1, which was located in a bare field on an exposed ridgetop. The snow cover during this period was intermittent, and was slightly greater in the forest areas.

From mid-December to early March, the snow cover was continuous at all stations. At the 12 forest stations,[4] none of the soils was frozen; the snow cover averaged from 17 to 31 inches during February, the coldest month of 1936 (the average minimum daily air temperature was 7° F.). Soil temperatures at one inch at these stations were very close to 32° F. throughout the period, irrespective of air temperatures (Tables 1, 2). A snow depth of 10 to 17 inches also prevented the soil from freezing at 6 field stations (5 abandoned meadow and one pasture). Since the soil temperatures were very close to 32° F., and since some of these stations were frozen during the more open winter of 1934-1935, it would appear that the snow cover in 1935-1936 was barely sufficient to prevent frost penetration. On the other hand, at the bare field station J1, a snow cover of 7 inches was insufficient to prevent the soil from freezing to a depth exceeding 30 inches, by mid-February. The average minimum soil temperature at one inch at this station was 22.8° F. during February (Table 1) and was strongly influenced by periods of low air temperature. A snow depth of 58 inches, however, prevented bare field station A8 from freezing. This station is typical of small areas on the lee sides of

TABLE 2

EFFECT OF TYPE OF COVER AND TOPOGRAPHIC POSITION ON THE ACCUMULATION OF SNOW AND WEEKLY SOIL TEMPERATURES AT PAIRED STATIONS DURING FEBRUARY 1936

Type of cover	Sta.	Depth of snow cover (inches): Mean	Depth of snow cover (inches): Mean difference[1]	Soil temperature: One inch depth: Highest	Soil temperature: One inch depth: Lowest	Soil temperature: Five inch depth: Highest	Soil temperature: Five inch depth: Lowest
UPLAND							
Exposed ridgetop, 1,970 feet elevation							
Bare field	J1	7.4	17.59±0.48	32	21	31	24
Dense maple forest	BX1	25.1		33	32	35	34
Exposed south slope, 1,560 feet							
Meadow (abandoned)	K4	10.5	6.83±0.28	33	32	33	33
Open oak forest	S1	17.4		33	31	33	33
Sheltered east slope, 1,935 feet							
Bare field	A8	58.8	28.00±0.52	35	32	34	33
Closed maple forest	LC	30.8		33	32	34	33
VALLEY							
Sheltered east slope, 1,250 feet							
Meadow (abandoned)	B2	16.7	1.47±0.32	34	33	35	34
Closed maple forest	BX8	17.9		33	32	35	34
Sheltered south slope, 1,400 feet							
Brush lot pasture	S2B	15.9	2.34±0.21	34	31	35	34
Dense aspen forest	K1	18.4		33	31	33	33

[1]Mean difference ± standard error, as calculated by Student's method with argument t, Laboratory Exercises in Biometry, Cornell University.

[4]The data at 7 unpaired forest stations were so similar to those of the 5 paired forest stations, that they have not been presented.

hill tops, where deep drifts accumulate, while bare field station J1 is typical of large areas of exposed hill land in south-central New York, where snow cover is scanty (Figure 1). In contrast, the forest areas were unfrozen, and possessed a deep, even cover of snow (Figure 2).

Frost Conditions and Their Influence on the Floods of March

None of the 12 forest stations, and only one of the 8 open field stations possessed frozen soil during the serious floods of March 1936. The bare field station J1, which had frozen deeply during late February remained frozen between depths of 5 and 30 inches during the peak of the flood period (Table 3). At the remaining 9 paired stations, the soil temperatures throughout the soil profile were almost identical—slightly above 32° F., irrespective of vegetation cover and wide differences in degree of subsoil drainage. In addition, the soil temperatures at 10 unpaired stations (7 forest and 3 abandoned meadow) were slightly above 32° F., with the ground unfrozen. The acreage of frozen soils at the Arnot Forest, during the flood period, was small, and was confined to open exposed fields.

According to Lamb, as reported by La Mont (3), 6.4 inches of precipitation fell at the Arnot Soil Conservation Experiment Station, from March 10 to 19, 1936 on the snow cover which had been slowly melting since February 24. From March 10 to 19, 7.9 inches of run-off were recorded from the frozen bare field on an exposed ridgetop. Station J1 was located within this field (this same area was also frozen a major portion of the winter of 1934-1935). Little or no run-off was recorded from the well-drained forest soils, none of which was frozen during this

Table 3

EFFECT OF FOREST COVER, GRASS COVER, AND LACK OF COVER ON MAXIMUM SOIL TEMPERATURE READINGS RECORDED WEEKLY AT PAIRED FOREST AND OPEN FIELD STATIONS, MARCH 4-18, 1936

	Maximum soil temperatures											
	1 in. depth March			5 in. depth March			12 in. depth March			30 in. depth March		
Cover	4	11	18	4	11	18	4	11	18	4	11	18
Upland												
Exposed ridgetop, 1,970 feet: BX1, sugar maple-beech-yellow birch; J1, bare field												
Bare	**30**[1]	33	34	**28**	**32**	**33**[2]	**28**	**31**	**32**	**30**	**31**	**33**[2]
Forest	33	34	33	34	34	34	35	35	34	36	37	36
Exposed south slope, 1,560 feet: S1, chestnut oak; K4, meadow (abandoned)												
Grass	32	35	41	33	34	36	34	34	36	35	35	37
Forest	32	32	34	33	33	34	34	33	34	36	36	36
Sheltered east slope, 1,935 feet: LC, sugar maple-beech-yellow birch; A8, bare field												
Bare	34	33	33	33	34	33	34	35	34			
Forest	33	33	33	33	34	34	34	35	34	35	35	36
Valley												
Sheltered east slope, 1,270 feet: BX8, sugar maple-beech-yellow birch; B2, meadow (abandoned)												
Grass	33	34	37	34	34	34	35	34	35	36	37	37
Forest	34	32	33	34	33	34	35	34	34	36	35	36
Sheltered south slope, 1,400 feet: K1, aspen; S2B, brush lot pasture												
Grass	33	33	34	33	33	35	34	33	36	36	35	37
Forest	33	32	33	34	33	34	35	34	35	36	36	36

[1]Temperatures which are in bold face type indicate that the soil was frozen at that depth. A check was obtained by thrusting an iron pin into the ground in nearby areas.

[2]The actual soil temperature readings were 32.5° F.

period.[5] This favorable forest influence may be attributed to the greater depth of snow (Figures 1, 2), which served as a natural reservoir as well as to protect the soil from freezing.

The Drifting of Snow

There are often sharp local differences in the accumulation of snow at paired forest and open field stations in upland areas. For example, the snow cover averaged 25.1 and 7.4 inches during February 1936, in a sugar maple-beech-yellow birch forest area, and an adjacent bare field, respectively (Table 2). These stations (identical except for type of cover) were located on an exposed ridgetop, and are typical of large areas of hill land. In contrast, on a sheltered east slope, less than 500 feet from the preceding pair of stations, the mean depths of snow were 30.8 and 58.8 inches in the forest and bare field, respectively. The drifting of snow appears to be the most important factor affecting the distribution and accumulation of snow in upland areas, especially on the exposed northwest, west, and southwest slopes of the major stream valleys, and on the hill tops. Dense hardwood cover, however, reduces very effectively the amount of drifting, as compared with bare fields and herbaceous cover on abandoned fields.

Retention of Snow

Differences in air temperatures between forest areas and open fields appear to be a minor factor affecting the retention of snow, since there was less than 1° F. difference between the mean daily temperatures during the flood period, March 9 to 21, 1936, (thermograph records at forest station LC, and adjacent open field station J1). These stations were less than 1,000 feet apart. The maximum temperatures were slightly higher in the open than in the forest; the mean difference from March 9 to 21 was $2.50° \pm 0.70$ (standard error).

The depth to which snow had accumulated during the winter was the factor of greatest importance determining the sequence in which the stations became bare. A study of the paired forest and open field stations shows a tendency for the mean difference in depth of snow during February to nearly equal the depth of snow left at the forest station when the

Fig. 1.—Open, exposed hill top at station J1, frozen to a depth exceeding 30 inches, despite scanty, continuous cover of snow. Note the large areas in the background swept bare of snow (southwest slope).

Fig. 2.—Les than 1,000 feet away from Figure 1, at station LC, on the same date, March 4, 1936, a 30 inch blanket of snow in the sugar maple-beech-yellow birch woods prevented the soil from freezing even at a depth of one inch.

[5]Heavy seepage run-off was observed on unfrozen, imperfectly drained forest soils. Ibid. Ecology 1938 (accepted for publication).

open station became bare of snow (Table 4). For example, the mean snow depth at forest station BX1 exceeded that of bare field station J1, 17.6 inches during February; on March 11, when the latter became bare, there were 17.0 inches of snow at the former. Thus, the data agree with those of Maule (4), showing that there is little difference in the rate of melting of the snow between hardwood forest areas, and adjacent open fields. The factors which affect the retention of snow in the uplands appear to be obscured to a large extent by differences in accumulation during the winter months.

During the floods of March 1936, the depth of snow cover was directly related to the type of vegetation cover and topography. Two upland stations located in open fields, on an exposed ridgetop and south slope, were bare on March 11, whereas 8 upland forest stations possessed a cover of snow which averaged 15 inches in depth. All of the valley stations in th open fields and forest areas possessed thin snow cover, except station K, whic was located on a steep, exposed sou slope in an open field. This one becam bare on March 5. Thus, the deepest sno cover on March 11 occurred at uplan forest stations.

Seven out of the 8 valley and uplan stations in the open fields were bare b March 16, just preceding the period heaviest percipitation. The two chestn oak stations (upland area), and two asp stations (valley area), which were locat on south slopes were also bare by Mar 16. In contrast, all 7 of the sugar map beech-yellow birch stations and one asp station were covered by snow averagi 11 inches in depth (the water equivale of this snow was approximately 3 inch according to data loaned by the Arm Soil Conservation Experiment Station These stations were located mainly

Table 4

INFLUENCE OF TYPE OF COVER ON THE RETARDATION OF THE MELTING OF SNOW AT PAIRED SOIL TEMPERATURE STATIONS, MARCH 4 THROUGH 20, 1936

Type of cover	Sta.	Depth of snow in inches March 4	9	11	13	16	18	20
Upland								
Exposed ridgetop, 1,970 feet								
Bare field	J1	4.0	2.5	0.0k[1]	2.0	0.0	0.0k	0.0k
Dense maple forest	BX1	23.0	22.0	17.0	19.0	11.0	10.0	10.0
Exposed south slope, 1,560 feet								
Meadow (abandoned)	K4	4.5	0.0	0.0	5.0	0.0	0.0k	0.0
Open oak forest	S1	12.0	7.5	3.5p	6.0	0.0	0.0k	0.0
Sheltered east slope, 1,935 feet								
Bare field	A8	55.0	53.5	48.5	45.0	39.0	39.0	39.0
Closed maple forest	LC	31.0	28.5	25.5	20.5	17.5	18.5	17.0
Valley								
Sheltered east slope, 1,270 feet								
Meadow (abandoned)	B2	14.0	8.5	3.0p	3.0p	0.0	0.0k	0.0
Closed maple forest	BX8	17.0	14.5	10.5	9.5	6.0	6.0	5.0
Sheltered south slope, 1,400 feet								
Brush lot pasture	S2B	12.5	7.0	2.5p	4.0	0.0	0.0k	0.0
Dense aspen forest	K1	13.0	8.0	4.0p	5.0	0.0	0.5	0.0

[1]Areas which possessed a cover of snow less than 0.5 inch, were recorded as 0.0k. In m areas, the snow disappeared unevenly, thus exposing patches of bare ground, and in such ca the average depth of the snow cover was weighted with the bare areas, and the letter p added to the reading.

north and east slopes and ridgetops in upland areas. The snow depth readings for March 18 and 20, during and after the peak of the flood period, were almost identical with those of March 16. Thus, the open fields were, in general, bare prior to and during the peak of the March floods, whereas the majority of the forest areas possessed a snow cover prior to, during and after the flood period. The presence of forest cover was, therefore, of considerable value in reducing the amount of water from melting snow which reached the soil during this flood period.[6]

Application of Results and Summary

The acreage of frozen soil during the winter of 1935-1936 and the floods of March 1936 was confined principally to bare, exposed fields which possessed a scanty cover of snow during the winter. The soil was neither frozen at 12 hardwood forest stations (7 sugar maple-beech-yellow birch, 2 chestnut oak, and 3 aspen), nor at 6 stations possessing an herbaceous cover. These stations were protected by a relatively deep snow cover during the winter. Thus the acreage of frozen soils at the Arnot Forest was small during the floods of March 1936, although the press stated that frozen soils were omnipresent in the region.

Hardwood forests, as compared with bare fields and herbaceous cover, greatly reduced the drifting of snow thereby favoring a deep, well-distributed cover of snow. Eleven inches of snow remained at 8 forest stations on March 18, 1936 (peak of the March flood), whereas 7 out of the 8 open field stations became bare several days before March 18. If snow and soil temperature data were collected systematically during the winter months, maps could be compiled showing the areas where snow cover is irregular and the soils freeze deeply. The reforestation of such areas and the protection of existing forest lands should reduce the acreage of frozen soils and increase the retention of snow, thereby reducing the peaks of floods.

Literature Cited

1. Grover, N. C. 1937. The floods of March 1936, Part I. New England Rivers. U. S. Geol. Sur. Water-Supply Paper 798.
2. Howe, F. B. 1935. Classification and agricultural value of New York soils. Cornell Univ. Agr. Exp. Sta. Bull. 619.
3. La Mont, T. E. 1937. Land utilization and classification in New York, and its relation to roads, electricity and reforestation. Cornell Univ. Agr. Exp. Sta. Ext. Bull. 372.
4. Maule, W. L. 1934. Comparative values of certain forest cover types in accumulating and retaining snowfall. Jour. For. 32: 760-765.
5. Ryder, C. E. 1936. The floods of March 1936 in Pennsylvania. Dept. of Forests and Waters, Commonwealth of Penna.
6. Society of American Foresters. 1932. Forest cover types of the Eastern United States. Jour. For. 30: 451-498.

[6] Seven out of the 10 wells located on the well-drained soils, which were still covered by snow on March 18, were dry, whereas water tables were present at 8 out of 10 wells where the snow had disappeared (see footnote 5).

SUSTAINED YIELD VERSUS CLEARCUTTING—A HYPOTHETICAL CASE

By A LUMBERMAN[1]

The following article gives a vivid picture of the lumberman's point of view and the difficulties and trials encountered in trying to adopt a sound forestry program on a sustained-yield basis. This is a live problem calling for a prompt solution in many parts of the country if sustained-yield management is to be adopted before it is too late. Comments by J. M. Walley and W. S. Bromley of the Milwaukee Office of the Forest Service are attached and further comments on the hypothetical problem presented will be welcomed by the JOURNAL.

FOR many years I have been advocating sustained-yield forest management in the mixed hemlock-hardwood forests of Michigan and Wisconsin. I have maintained that with suitable forest taxation and adequate fire protection which both states provide, with our good forest soils and climatic conditions, with our peculiarly valuable forest species and ascertained net forest growth, and with the long trend toward lower interest rates, private capital would be induced to undertake sustained-yield management in this region.

While I have pointed to obstacles to forest management, it has been in the hope of overcoming them. There still remains the obstacle of public apathy toward the future and public greed for the immediate present. If there were an enlightened public sentiment for the present sacrifice involved in the conservation of our forest resources, we might save our remaining merchantable timber stands from destruction and maintain the life of our forest industries.

A sustained yield forest in this region is capable of maintaining a 4 per cent annual growth, and this looks like a 4 per cent annual return on the forest capital. With the risks sufficiently removed, such a return would invite private capital. But between growth and return to the owners, the public imposes such obstacles that the owners are still forced to cut out and get out.

I shall illustrate this situation by a hypothetical case which faithfully presents the existing situation. I have chosen Wisconsin, but for Michigan the end results would be the same. This case also reflects the character of private timber ownership to which we are drifting in this region.

There is dissatisfaction on the part of the stockholders with the management of a forest industry corporation. Consultants in forest finance are called upon and they present a report.

Description of Property.—The property consists of 100,000 acres of selectively cut timberland, of which 80,000 acres represents productive forest with a residual stand of 5 M. feet per acre; truck trails, sawmill, auxiliary woodworking plants, having a single shift capacity of about 16,000 M. feet of sawtimber per year.

Valuations.—No valuation is placed on the land. The unit value of timber is $5 per M. feet. The record of earnings discloses that the plant can earn, on the average of good and poor years, $5 per M. feet in the conversion of its timber before depreciation and taxes. The depreciated value of the plant is $500,000; the

[1]EDITOR'S NOTE: This is not an anonymous article. The author is known to the North Central Region of the Forest Service. In view of the fact that the hypothetical case described might be interpreted as applying to the author's actual forest problem, and also because it is hoped that anonymity may contribute to a freer discussion of the problem, the editor has consented to publish the paper without the author's name.

value of logging and other equipment amounts to $100,000; the inventories $300,000 and the accounts receivable $100,000.

Report of the Operation on a Sustained Yield Basis

ASSETS		
Timber	$2,000,000	
Plant	500,000	
Equipment	100,000	
Inventories	300,000	
Accounts receivable	100,000	
Total assets	$3,000,000	
EARNINGS BEFORE DEDUCTIONS FOR DEPRECIATION AND TAXES		
Annual growth 200 ft. per acre on 80,000 acres, or 16,000 M. ft. @ $5.00		$80,000
Conversion profit: $5.00 per M. ft. on annual cut of 16,000 M. ft.		80,000
Total earnings		$160,000
DEPRECIATION AND TAXES		
Because of the long life expectancy—		
2 per cent depreciation on plant	$10,000	
5 per cent depreciation on equipment	5,000	
Total depreciation		15,000
Capital stock tax of 0.1 per cent on declared value of $2,000,000	$2,000	
Timberland entered under forest crop law—tax 10c per acre on 100,000 acres	10,000	
Severance tax 10 per cent of value of cut	8,000	
Ad valorem taxes—plant, equipment and inventories assessed at 60 per cent of book value or $540,000 with annual tax rate of 4 per cent	21,600	
Social Security taxes state and federal averaged over future years are conservatively placed at 3 per cent, and by reason of the intensive utilization of products, the annual payroll is $500,000; or a tax of	15,000	
Total taxes		$56,600
Total taxes and depreciation		71,600
Average taxable net income		$88,400
Estimated total state and federal income taxes (25 per cent)		22,100
Estimated income available for distribution		66,300
Less privilege dividend tax of 2½ per cent		1,600
Net to stockholders		$64,700
Return on forest and conversion capital		2.18 per cent

These calculations present a net income to stockholders of 2.18 per cent for the timber and conversion plant through an indefinite period of future years. The past record of the operation substantiates the assumed earnings, but only by averaging good and poor years. There were successive years during which the owners received no income; also profit years in which the earnings greatly exceeded the average.

The report was submitted to the directors, who were dissatisfied with the showing. They called for a second report, asking for the return of capital and income on the basis of clear cutting the timber over a period of fifteen years.

In the second report, the consultants indicated that to cut all the timber now standing, together with the growth increment during the 15 year period on the portions awaiting cutting, would involve approximately the present stand plus one-half the present annual growth for fifteen years, or 400,000 M. feet plus 120,000 M. feet, or a total of 520,000 M. feet, which would be cut at the rate of 34,000 M. feet per year. To increase the cut from 16,000 M. feet to 34,000 M. feet would involve operating double shift and certain enlargements of plant and working capital, estimated at an additional investment of $500,000.

Report of the Operation on a 15-year Liquidation Basis

ASSETS	
Timber	$2,000,000
Plant	600,000
Equipment	200,000
Inventories	500,000
Accounts receivable	200,000
Total assets	$3,500,000

As the timber would be cut and the plant and equipment amortized and the inventories sold, all of the assets would be liquidated during the 15 year period. Therefore, there would be an average return of capital for the year of 1/15 of \$3,500,000, or \$233,333 per year.

EARNINGS BEFORE DEPRECIATION AND TAXES	
Estimated annual growth averaged during the 15-year cutting period—8,000 M. ft. @ \$5.00	\$40,000
Conversion profit: \$5.00 per M. ft. on annual cut of 34,000 M. ft. before depreciation of mill and equipment	170,000
Total earnings	\$210,000
DEPRECIATION AND TAXES	
Depreciation on plant and equipment on basis of 15-year life—7 per cent of \$800,000	\$56,000
Capital Stock Tax on declared value \$2,500,000	2,500
Forest crop tax—10c per acre on 50-000 acres (lands to be dropped as soon as cut)	5,000
Severance tax 10 per cent of value of stumpage cut	17,000
Ad valorem taxes—plant, equipment and inventories assessed at 60 per cent of book value or \$720,000 with annual tax rate of 4 per cent	28,800
Social Security taxes state and federal 3 per cent on estimated payroll of \$900,000	27,000
Total taxes and depreciation	\$136,300
Average taxable net income	73,700
State and federal income taxes @ 25 per cent	18,425
Income available for distribution	55,275
Less privilege dividend tax of 2½ per cent	1,380
Net to stockholders	53,895
Average annual return of capital	233,333
Total net income and return of capital	\$287,228

It will be noted that the annual net earnings available for distribution to stockholders are \$53,895, or only 1.5 per cent on the invested capital of \$3,500,000, in spite of the greater gross profit. It is also noted that the return on the sustained yield basis is greater, being estimated in the original report at 2.18 per cent.

Upon the receipt of these two reports, the chairman of the board of directors called a meeting of the stockholders. Both reports were read and explained to them. The stockholders were disappointed with both reports and talked about the returns they might receive *regularly* from high grade securities.

A trust company officer representing minor beneficiaries asked for Chapman's "Forest Valuation," and after an adjournment for lunch, he presented his calculations, as follows:

"Ladies and gentlemen, we consider this forest industry operation comparatively safe and very efficiently managed, but yet it is a lumber company. We recognize the downward trend of income from safe securities. Several years ago we would have insisted on a yield of at least 5 per cent plus 2 per cent for risk, or 7 per cent. We are satisfied now with 3 per cent with an additional 1 per cent in this case for risk, or a total of 4 per cent. Do you all agree with me?"

The stockholders said they did.

"Under the sustained-yield plan the present worth of the property capitalized at 4 per cent is approximately \$1,650,-000. Under the plan to cut out in 15 years, we receive annually in dividends and returned capital \$287,000 for fifteen years. The present value of these annual returns, discounted at 4 per cent, is 11.-1184 times the annual payment, or nearly \$3,200,000. Deducting from this the \$500,000 additional capital needed for this plan gives us a present value of \$2,700,000. That is to say, on 4 per cent capitalization, the present value of our property on the 15 year plan is \$1,100,-000 more or 70 per cent greater than on the sustained yield plan."

The chairman of the board asked the consultants to verify these statements of present value. They did so and found them approximately correct.

The president of the company made a vigorous plea for the sustained yield plan. He said: "If we had not changed from clear cutting to selective cutting twenty

years ago, we would now be through. This beautiful forest region supporting a thousand families in agriculture and forest industry would have become idle, unproductive and deserted. These stockholders who most of you here represent are children and grandchildren of the founders of the company, who saved and toiled to create it. Have these newer generations no sense of family tradition? Have they no sense of their moral obligation to the people of this community who have served the operation faithfully for fifty years, for two generations and the beginning of a third generation? Have these stockholders no interest in this forest enterprise or concern for the community dependent upon it?"

The trust officer replied: "There is no provision for sentiment, family pride, or community spirit in the trust covenant. Such obligations on ownership were not recognized by the state or federal governments in determining the inheritance taxes that had to be paid for the present owners to come into possession. In some cases, these taxes have been as much as the stock was actually worth. I am not unmindful of the public interests involved in our decision here, but it seems to me that it is the public—the county, state and federal governments—forcing us to liquidate."

A young man at the meeting said: "I have a proxy from my wife who is the granddaughter of the originator of this enterprise. We live in New Orleans. We have an opportunity to invest in a newsprint plant and are very anxious to do so. I would like to sell her stock, but I find no one willing to buy it. I would very much like to get her money out of this enterprise. There are several trust officers here. Will any of them make me an offer?"

No offer was forthcoming.

One of the forestry consultants made the following suggestion: "This discussion of our two reports has opened our eyes to the real situation. These reports have been presented to the owners who differ with the more socially-minded management. The owners do not know much nor care much about the operation, except in dollars and cents. The management takes pride in the business and is concerned for the people engaged in it. But there is a third party in interest—the public which, on the face of these reports, does seem to be forcing quick liquidation against its own interests. Will you not, therefore, defer definite action for say one year so that my associates and I may present this situation to those charged with responsibility for the public interest in the continued operation of this forest enterprise here where it is now located?"

After some discussion, this course was agreed to.

This hypothetical case is capable of many variations, and in some more favorable regions, the sustained-yield plan may appear the more desirable. But in those regions where, by reason of surrounding obstacles, private ownership will fail, is there no way out short of public acquisition? This, I believe, presents an important problem in the development of a realistic public forestry policy.

COMMENTS

By J. M. Walley and W. S. Bromley
U. S. Forest Service

After a review of the previous article, "Sustained Yield Versus Clearcutting," one must admit that liquidation with clearcutting may produce the greatest profits for short periods, even for companies that are actually operating on a sustained-yield plan. The article acknowledged many outstanding advantages of a sustained-yield operation. Full consideration of the value of growth offsetting depletion is recognized. A lower rate of depreciation is allowed under sustained-yield. The conversion profit per M. bd. ft. is shown as being equal under sustained-yield and liquidation, in spite of the advantage which the latter should have along lines of lower unit cost of production with the higher annual cut.

No provision was made in either problem for the use of the sinking fund methods of amortizing the return of capital. This would have permitted lower charges for depreciation, depletion, and the like, but would not have affected the final conclusions very much.

The use of present-worth calculations in problems of forest finance is recognized as orthodox procedure. No one using the present-worth analysis should lose sight of the fact that the present-worth formulae assume that a large portion of each annual income is reinvested each year at the interest rate used. It is not always possible to make safe investments each year that will yield 4 per cent interest.

It will be noted that timber, inventories, and accounts receivable under the sustained-yield plan are set up as constants. Under the liquidation plan these assets as well as the plant and equipment are fully depreciated during the life (15 years) of the operation. Obviously, the "conversion profit" in both cases includes the depreciation on mill and equipment, but does not include under liquidation depreciation on the other assets. The depreciation charge, or return of capital on mill and equipment, of $15,000 under sustained-yield and $56,000 (actually $53,333) under liquidation is deductible from taxation. It is a return of capital and not a part of the net profit. It must be added to the net profit, however, to determine the total net income. This was not done in the sustained-yield plan. The $15,000 should be added to the net profit of $64,700 thus making a total net income of $79,700.

The calculated present worth of the income under liquidation at 3 per cent (leaving out 1 per cent for risk) is approximately $2,926,000. Under sustained-yield the annual income of $79,700 has a capitalized value at 3 per cent of $2,657,000. Thus on a basis of 3 per cent the relative values of each form of operation are brought much closer and might invite the consideration of the stockholders of the company to retain its timber and attempt to obtain higher net income under sustained-yield by developing new markets, increasing efficiency of logging and milling, and other measures.

Since it is impractical to disregard the element of risk, the point is raised as to the soundness of the practice of ascribing one per cent to cover the "risk" under liquidation as well as under sustained-yield. Six per cent, or more, is usually the goal of the average stockholder. Does not a company that is working under the pressure to make high profits in a short time subject itself to greater risks than the more conservative operations? Would an owner who clear cuts and abandons his lands as soon as they are cut over be allowed by the state to keep his land

listed under the Forest Crop Law? Mills designed to operate at capacity on a double shift would have a hard time "catching up" with schedule if production were lowered during periods of business recession. Not nearly as full advantage could be taken of favorable markets and conditions under the liquidation plan as under sustained-yield. Another disadvantage or risk of liquidation with clearcutting compared to selective cutting is the greater danger of loss from forest fires. Materially increasing production under liquidation would give more employment (for a short time) and increase the chances of labor troubles, at least at the outset of the operation. Dependent workers realizing that they will soon have to look for another job have a lower morale which decreases their efficiency.

It would seem that a risk rate of 4 per cent would be reasonable under the liquidation plan. This, added to the 6 per cent interest rate that the stockholders demand, gives a true measure of the "profit and risk" that should be used in the present-worth formula. Hoskold's modification of the formula which is generally used provides for a high or speculative rate of return on a hazardous or semihazardous investment. It provides also for a conservative rate of return on the sinking fund payments, or reinvestments required to amortize or return the investment as the capital or assets diminish.

$$\textit{Hoskold's Formula} = V = \frac{P}{\dfrac{.op}{1.op^{n}-1} + .or}$$

Where V = Present worth
P = Total annual income
n = Number of years for liquidation
p = Rate of interest on reinvestment or sinking fund rate
r = Rate of discount, including allowance for profit and risk expressed in per cent, and usually called risk rate.

Using this form of analysis, the annual return of $287,000 under liquidation has a present worth of $1,860,000, if the profit and risk rate r is placed at 10 per cent, and the reinvestment rate p is placed at 3 per cent. This produces a more accurate picture of the true nature of an operation that is planning to liquidate in comparatively short periods. When this present worth is compared with the capitalized value of the $79,700 annual income at 4 per cent (allowing one per cent for risk), the sustained-yield operation shows up with a value of $1,990,000, and in the illustration used is actually worth more as a sound investment than the operation based on liquidation in 15 years.

The use of Hoskold's formula is introduced to emphasize the fact that great care must be used in comparing incomes from liquidating operations with those set up on a long-term or continuous operating basis. Perhaps the rates used do not apply to the case at hand, but the main points of the comparison made hinge so very definitely on the use of present worth valuations that the conclusions drawn in favor of liquidation must be questioned as to the method of analysis.

Since the facts presented in the article lead to the implication that sustained yield might be possible if the heavy tax loads were reduced, more discussion should be presented on this point. To test the probability of this implication, all taxes listed in the previous article were cut in half. This reduction would theoretically give the sustained-yield operation an annual net return of cash amounting to $116,000. The capitalized value of this income at 4 per cent amounts to $2,900,000; i.e., more than the company is worth under liquidation at the present tax rates, using any of the analyses discussed. The point raised concerning taxes as an impediment to sustained yield undoubtedly merits thoughtful consideration on the part of all who come in contact with this problem.

In spite of this criticism of the method

of evaluating the income under liquidation, the article points out the difficulties that must be solved in one way or another before sustained yield will be accepted as the most desirable course of action by private industry in this country. If it is impossible to increase returns from selective cutting by improved logging methods, reduction of taxes, and other means so as to place the operation on a par with clear-cutting, it seems that the only solution is a reduction of the capital investment in timber. This may require direct participation and partnership by the public in sustained-yield through ownership of part of the growing stock, or through regulation of forest practices, or both.

Effective aid and cooperation should be made available to owners and operators who will deliver an adequate *quid pro quo*. Regulation also may still be necessary to adequately protect such operators as well as the public.

Protection Offsets Fire Dangers in Dry Forests

Although weather conditions brought a serious forest fire hazard in many parts of the country during 1937, recent improvements in fire-protection service more than offset the tindery dryness of most of the forest areas, U. S. Forest Service records show.

From 1932 to 1936 the average acreage burned annually in the National Forests was nearly 338,000 acres. Up to the middle of November, 1937, only 99,348 acres had been burned, although the number of fires (11,208) exceeded the average annual number of the 5 preceding years by almost 1,500. Of the more than 11,000 forest fires which broke out in the National Forests, all but 240 were controlled within the first 24 hours. More than 90 per cent were held to less than 10 acres.

SOIL ADAPTABILITY OF WHITE SPRUCE

By J. H. STOECKELER
Lake States Forest Experiment Station[1]

In the study of silviculture, foresters attempt to classify various tree species according to tolerance, soil needs, and climatic requirements. White spruce has generally been classified as being adapted to acid soils. The data here presented bring up an interesting exception to the rule in which this species was found growing on very calcareous soils in the province of Manitoba, Canada.

WHITE spruce (*Picea glauca* (Moench.) Voss) is found over rather extensive areas in Wisconsin, Michigan, and Minnesota and commonly occurs on slightly to moderately acid soils having good moisture relations. In Minnesota the most extensive areas of white spruce occur in and adjoining the Superior National Forest where it is associated with black spruce, balsam fir, jack pine, paper birch, and aspen, and is generally found growing in or on the margin of swamps, or on the moist uplands. In northern Wisconsin and Michigan white spruce is found in similar situations and is generally associated with hemlock, balsam fir, white pine, and aspen, or in rather small patches mixed in with the hardwood-hemlock stands.

The only study of soil requirements of white spruce in the Lake States was made by Wilde[2] whose data indicate that in the state of Wisconsin, this species is found on soils having an average silt and clay content of 25 per cent, an average pH of 5.2 and a total nitrogen content of .257. Other nutrients such as phosphorous and potash were also comparatively high. These values are generally considered as applying also to Michigan and Minnesota although Rosendahl and Butters[3] make the observation that the species is often found on moderately calcareous upland soils in Minnesota and Canada.

Their notation is further supplemented by Professor P. R. McMiller of the Division of Soils, University of Minnesota, who has observed[4] this species growing on the Beltrami and Nebish soil series in the vicinity of Northome, Minnesota, where these soils are often calcareous within 18 inches of the surface.

These empirical observations would indicate that white spruce has adapted itself to a considerable range of soil conditions, especially as it approaches its western limit of range.

That such is indeed the case is further substantiated by an analysis of soils obtained by the writer from two distinct areas in the province of Manitoba, Canada.

Each of the two profiles is considered as being typical of an area of considerable size, because examination of a number of road cuts showed the same general characteristics, especially as regards texture and presence of lime rather close to the surface.

The first profile sampled was located in a rolling morainic area about one mile west of Clear Lake and eight miles north-

---

[1]Maintained in cooperation with the Division of Forestry, University of Minnesota.

[2]Wilde, S. A. Adjustment of soil fertility in coniferous nurseries: 1. Control of nutrients and associated conditions in virgin forest soils. Technical Note No. 19, Soils Department, University of Wisconsin, May 7, 1937.

[3]Rosendahl, C. O. and F. K. Butters. Trees and shrubs of Minnesota. University of Minnesota Press. 1928.

[4]Information obtained through personal interview.

west of the town of Wasagaming in Township 20 North of Range 19 West, Riding Mountain National Park. The samples were obtained from a road cut in a thrifty stand of white spruce ranging from 40 to 60 feet high, 6 to 12 inches in diameter, with an estimated age of 80 years. The spruce was associated with aspen and balsam poplar which ranged in height from 40 to 70 feet.

The second profile was located south of the provincial Spruce Woods Forest Reserve in Township 8 North of Range 14 West, and was approximately 8 miles north of Glenboro. This was in an open scattered stand of spruce from 4 to 8 inches in diameter, 20 to 35 feet high, and estimated to be about 50 years old. The trees were healthy in appearance but decidedly slower growing than the spruce in Riding Mountain National Park. The stand was on an area of calcareous waterlain sand which had been reworked considerably by wind action before having been stabilized by vegetation and was somewhat dune-like in character and topography. The white spruce here was associated with a scrubby growth of quaking aspen 15 to 30 feet in height, bur oak 10 to 15 feet in height, hazel brush, wild rose, and deep-rooted grasses.

An analysis of the soil from the two profiles is given in Table 1. During examination of the profiles, it was observed in both cases that some roots had penetrated into the calcareous underlying material to depths of 3 or 4 feet, thus indicating a considerable degree of lime tolerance for this species.

The most interesting feature about the profiles is the rather high pH and the calcareous nature of the soil, especially of the deeper zones. It is evident that there is an abundance of carbonates in the soil and that the rather limited rainfall has not succeeded in leaching them out to any great depth, thus producing a profile which in some respects is more typical of the subhumid Great Plains than of the average forest soil located in an area of heavier rainfall.

Meteorological data[5] for Dauphin, which is 29 miles north of Profile 1, indicate a normal annual precipitation of

TABLE 1[1]

ANALYSIS OF TWO SOIL PROFILES SUPPORTING STANDS OF WHITE SPRUCE

Profile No.	Depth of zone in inches	Depth at which sample was taken	Mechanical analysis[2] Sands	Silt	Clay	Carbonates	pH[3]	Total nitrogen	Available phosphorous[4]	Available potash[4]
			Per cent			Per cent		Per cent		
1	0-4	2	77.8	11.3	10.9	0.0	6.2	.166	Low	Very high
Riding Mt.	4-17	10	91.7	5.9	2.4	8.2	7.6	.053	Medium	High
National	17-32	20	67.0	20.5	12.5	29.8	8.4	.056	Low	High
Park	32+	34	88.5	8.1	3.4	26.0	8.4	.019	Very high	Medium
2	0-6	4	92.9	2.7	4.4	Not tested	6.4	.152	Low	High
Near	6-12	9	91.4	2.7	5.9	Not tested	6.4	.036	Low	Low
Sprucewoods	12-24	17	94.5	2.3	3.2	Not tested	6.6	.033	Very high	Low
Forest	24-40	30	95.0	1.6	3.4	Not tested	8.0	.012	High	Very low
Reserve	40+	60	95.8	2.6	1.6	Not tested	8.2	.009	High	Very low

[1]Analyses by Division of Soils, University of Minnesota.
[2]Carbonate-free basis.
[3]Tested with LaMotte kit and checked by hydrogen electrode method.
[4]Indiana Test Kit.

[5]Furnished through the courtesy of Mr. H. Campbell of the Meteorological Service of Canada, Winnipeg, Manitoba.

17.74 inches, of which 12.33 inches fall from April 1st to October 31st inclusive. At Brandon, which is 37 miles west-north-west of Profile 2, the normal annual precipitation is 17.03 inches, of which 13.69 inches fall from April 1st to October 31st inclusive.

The data indicate that rainfall in this section of Manitoba is rather limited and that the area near Profile No. 1 receives more of its precipitation in the form of snowfall. The precipitation, however, must be considered as highly effective for tree growth because of rather low evaporation rate and high infiltration rate for the two sites examined.

Profile No. 2 is striking in that the soil has a very low per cent of silt and clay and it is rather amazing that white spruce is able to adapt itself to such a poor calcareous, droughty sand. The analysis of nutrients, especially of total nitrogen, indicates that the forest vegetation has increased considerably the nutrients in the top 4 to 5 inches of soil.

A final point indicating that white spruce is much more lime tolerant than is commonly supposed is the fact that it is successfully used in planting of shelterbelts in the prairie portions of Manitoba, Saskatchewan, and Alberta, where it is planted on highly calcareous chernozem and related soils.

REFORESTATION of National Forest areas, by tree planting and tree seed sowing, in 1937 exceeded that of any previous year, according to a report by the U. S. Forest Service. Trees were planted on 214,306 acres and tree seeds were sown on 8,769 acres—a total reforestation of 223,075 acres. To meet the planting needs, the present output of 32 National Forest nurseries scattered throughout the country is more than 225 million trees annually. Forest Service estimates show that 4 million acres of National Forest land are unproductive but capable of growing forests. Most of the planting was in the Lake States and the South. Much of the National Forest areas in these two regions is made up of land once privately owned and heavily cut and burned.

THE RELATION BETWEEN MYCORRHIZAE AND THE DEVELOPMENT AND NUTRIENT ABSORPTION OF PINE SEEDLINGS IN A PRAIRIE NURSERY[1]

By A. L. McCOMB
Department of Forestry, Iowa State College

The importance of mycorrhizae in the normal growth and development of forest trees has been, and still is a highly controversial question. Sufficient evidence has been accumulated during the past few years to leave little doubt of their importance in the normal growth and development of coniferous seedlings. Indeed, under certain conditions they appear essential. Such a case is described in the following article.

FOR a long time ectotrophic mycorrhizae have been known to occur on the root systems of many trees, especially the conifers, but few people realize their almost universal occurrence. Various theories have been advanced concerning the presence of mycorrhizae, how they function, and whether or not the fungi concerned in their formation are parasitic or symbiotic. Among the authors of papers on mycorrhizae there has been considerable disagreement and none of the theories advanced has explained completely many of the known facts.

Recently Hatch (3) has completed a comprehensive work dealing with mycotrophy in the genus *Pinus*. This work reemphasizes the significance of mycorrhizae in forestry and particularly in afforestation. Hatch's conception of the role of mycorrhizae, based upon a critical review of the published data of others, and upon his own experiments, is that mycorrhizae occur normally only in soils where there is a deficiency in one or more of a number of mineral nutrients. This theory was originally put forth by Stahl (9) in a slightly different form and is a considerable enlargement on the organic nitrogen theory[2] which in the past has had wide adherence (5).

According to Hatch's conception tree roots in soils deficient in one or more nutrient elements are attacked by mycorrhizae-forming fungi. As a result of the mycorrhizal formation, trees growing in these poor soils are able to obtain a more adequate supply of mineral nutrients for the following reasons: the greater surface area of the infected short (mycorrhizal) roots; the greater abundance of the obsorbing root ends due to the profuse branching of the mycorrhizal structure; the delay in suberization of the cortex and endodermis of the infected short roots; and the great extension of the fungal mycelium through the soil and the resultant increased surface for mineral absorption. Hatch's experiments, as well as those of Mitchell et al. (6), furnish proof of the role of mycorrhizae in aiding trees to absorb greater quantities of minerals in which the soil is particularly deficient, especially phosphorus, nitrogen, potassium, and calcium. These experiments indicate the obsolescence of the idea that tree mycorrhizae are usually non-symbiotic structures, and also of the conception that they are concerned only with the absorption of nitrogen in raw humus soils possessing few nitrates.

The present paper presents data which support the main thesis of the mineral nutrition theory of mycorrhizae. It con-

[1]Journal Paper No. J-539 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 482.

[2]Melin's later work apparently indicated the inadequacy of the organic nitrogen theory in explaining all mycorrhizal data.

trasts the results of growth and mineral absorption in mycorrhizal and non-mycorrhizal seedlings of Virginia pine (*Pinus virginiana* Miller) grown in a prairie nursery.

Experimental

In the spring of 1937 a new tree nursery was established at Ames, Iowa. This nursery was located on O'Neil sandy loam; a light black, high terrace soil ranging in pH from 5.8 to 6.5 and underlaid with gravel at a depth of 2 to 3 feet. The nursery site had been farmed for many years, but probably originally supported a sparse growth of oaks, shrubs, and native grasses.

In the coniferous section of the nursery a number of species of pines were planted. These included northern white pine, ponderosa pine, Austrian pine, red or Norway pine, Japanese red pine, and Viriginia pine. The pine beds were all planted in the interval from May 15 to May 30. Following planting, all of the beds, excepting those of red and Austrian pine, were mulched with pine needles brought in from a vigorous growing plantation of red and white pine in the near vicinity.

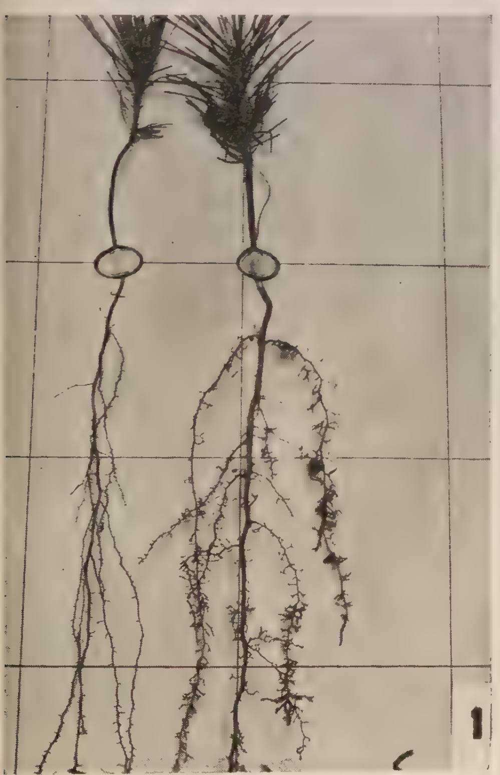

Fig. 1—Detailed view of mycorrhizal (right) and non-mycorrhizal (left) seedlings of *Pinus virginiana.*

Germination was good in all species except the Austrian pine, and all of the seedlings developed normally until about the first of August when the first fascicled needles were forming. At this time it was noted that in the beds mulched with pine needles there were certain spots where the seedlings appeared more vigorous than in the rest of the beds. As the growing season progressed these spots of seedlings remained green and vigorous while the remainder of the seedlings developed a stunted appearance and turned brown to reddish purple in color. This spotting occurred in all the beds mulched with pine needles although in the white pine bed the spots were not so pronounced and all of the seedlings appeared slightly yellowish green.

Upon searching for the cause of the spotted appearance of the beds, it was found uniformly that the vigorous seedlings possessed an abundance of ectotrophic mycorrhizae, while the stunted plants possessed few or none. This relationship was true of all the species mulched with needles although mycorrhizae were particularly abundant and their influence more pronounced in the case of the Japanese red and Virginia pines.

Because the outward manifestations of the mycorrhizal habit were more evident in the two species mentioned, one of them (the Virginia pine) was used in obtaining quantitative data. To obtain these data, a block of soil containing over 200 seedlings was removed from each of a mycorrhizal and non-mycorrhizal spot in the seed bed. The two blocks were within ten

feet of each other in the seed bed, and the soil pH between the blocks varied from 6.0 to 6.2. The soil was carefully washed from the seedlings and the damaged seedlings at the edges of the blocks thrown away. From the uninjured seedlings a sample of 20 was chosen at random from each lot. The remainder of the seedlings in each lot was divided into four samples, the number of seedlings in each sample varying from 25 to 50.

The twenty mycorrhizal and twenty non-mycorrhizal seedlings were examined to determine the nature of the mycorrhizae and counts were made of the number of mycorrhizal branches or tips and of the non-mycorrhizal short roots. The root classification of Hatch and Doak (4) was used. The same seedlings were used in measuring height growth. The following measurements of height growth were taken: from root collar to top of cotyledonary growth, from the top of cotyledonary growth to the bud, and total height. The growth from the cotyledons to the bud was believed to be most useful in evaluating the height growth response due to mycorrhizae because the initial growth effects due to the seed were probably less evident in this later growth.

The four samples of each lot were then analyzed as follows. The seedlings in each sample were counted and their green and dry weight determined. Finally each sample was analyzed[3] for total nitrogen, phosphorus, and potassium by the officia

Fig. 2—Section of nursery seed bed showing spotted appearance. Dark spot in front center contains mycorrhizal seedlings. Light areas are made up of non-mycorrhizal seedlings.

[3]I am indebted to the Plant Chemistry subsection, Iowa Agricultural Experiment Station, for these analyses.

methods of the Association of Official Agricultural Chemists (1).

The results of all comparisons are shown in Tables 1 and 2. The data are clear cut and there is little overlapping in the ranges displayed by the individual measurements. In all cases, however, significance was determined by the methods outlined by Snedecor (8).

Only the following salient facts shown in Tables 1 and 2 need be pointed out: where mycorrhizae were present both green and dry plant weights were doubled over the non-mycorrhizal seedlings; the mycorrhizal plants contained twice as much nitrogen and potassium and four times as much phosphorus as the others (totals per plant); on a percentage dry weight basis, there was little difference with respect to nitrogen and potassium content but the mycorrhizal plants contained twice as much phosphorus as did the non-mycorrhizal plants; total height growth of mycorrhizal plants was 35 per cent greater, and height growth from the cotyledons to the bud 60 per cent greater than that of the non-mycorrhizal seedlings; and the average mycorrhizal plant root system possessed over six hundred absorbing short roots and mycorrhizal tips or branches, while the non-mycorrhizal plants had only slightly over three hundred.

Fig. 3—Average mycorrhizal (right) and non-mycorrhizal (left) seedlings of *Pinus virginiana*. Note thicker stem, more abundant and longer needles, and profuse branching of roots of mycorrhizal seedlings.

The facts outlined indicate that the seedlings, in this soil, were unable to obtain an adequate supply of phosphorus without the aid of mycorrhizae. This evidence is supported by the knowledge that in the soil involved, phosphorus is the element generally limiting plant growth (7). The evidence supports the main thesis of the mineral nutrition theory of Stahl (9) and Hatch (3), although there is no evidence of the specific physiological mechanism or balance involved. Phosphorus was obviously limiting growth and nitrogen and potassium were apparently adequate for seedling growth at the existing level of soil phosphorus. The slight piling up of nitrogen in the non-mycorrhizal seedlings (Table 2) may have been due to the fact that phosphorus was limiting all growth and hence indirectly also limiting the use of nitrogen.

The origin and identity of the specific fungus or fungi involved in the mycorrhizal formation are not known. On the basis of the facts set forth it is reasonable to assume that this particular nursery soil did not contain fungi forming mycorrhizae on Virginia pine, nor mycorrhizae-forming fungi for the other pines planted. Hatch in another paper (2) reports the lack of mycorrhizae-forming fungi in a plains soil from the vicinity of Cheyenne, Wyoming, and reviews instances of prairie soil in Australia and Rhodesia lacking mycorrhizal fungi and supporting exceptionally poor seedling growth. It is probable that the mycorrhizae formed here developed from fungi introduced with the pine litter mulch and that the original soil either did not possess the specific fungi or that long years of cultivation in agricultural crops had eliminated them.

Regardless of the method of introduction of the fungi, mycorrhizae began to form during the growing season and their

Table 1

AVERAGE HEIGHT GROWTH AND MYCORRHIZAL DEVELOPMENT OF MYCORRHIZAL AND NON-MYCORRHIZAL PINUS VIRGINIANA SEEDLINGS

		Height growth			Short roots and mycorrhizal development[3]		
Sample	Number of seedlings	Root collar to cotyledons (*inches*)	Cotyledons to bud (*inches*)	Total (*inches*)	Number mycorrhizal short roots	Number non-mycorrhizal short roots	Total short roots
Mycorrhizal	20	1.34±.05[1]	1.36±.08	2.70±.09	350±28	321±22	672±32
Non-mycorrhizal	20	1.15±.06	0.85±.04	2.00±.06	7±2.1	297±15	304±15
Difference		0.19	0.51	0.70	343	24	368
T values[2]		2.65[4]	5.86[5]	6.3[5]	11.9[5]	0.88	10.2[5]

[1]Standard error.

[2]T values computed for 38 degrees freedom.

[3]Root classification of Hatch and Doak (4).

[4]Significant—below the 5 per cent level.

[5]Highly significant—below the 1 per cent level.

Table 2

WEIGHT AND NUTRIENT CONTENT OF MYCORRHIZAL AND NON-MYCORRHIZAL SEEDLINGS OF *Pinus Virginiana* GROWN IN A PRAIRIE NURSERY

				Nitrogen content		Phosphorus content		Potassium content	
Sample	Number of seedlings	Green weight of ave. plant (*mgs.*)	Dry weight of ave. plant (*mgs.*)	Per cent dry weight	Ave. per plant (*mgs.*)	Per cent dry weight	Ave. per plant (*mgs.*)	Per cent Dry weight	Ave. per plant (*mgs.*)
Mycorrhizal									
1	25	1228	322	1.79	5.76	0.178	0.57	0.64	2.06
2	25	1216	307	1.72	5.28	0.182	0.56		
3	40	1232	329	1.80	5.92	0.186	0.61	0.65	2.14
4	50	1246	333	1.81	6.03	0.192	0.64	0.69	2.30
Average		1230±6.1[1]	323±5.7	1.78±.019	5.75±.17	0.184±.003	0.60±.02	0.66±.015	2.17±.07
Non-mycorrhizal									
1	50	626	165	1.85	3.05	0.089	0.15	0.65	1.07
2	50	566	148	1.85	2.74	0.092	0.14	0.64	0.95
3	50	574	147	1.85	2.75	0.099	0.15	0.63	0.93
4	32	600	150	1.96	2.94	0.110	0.16	0.59	0.88
Average		592±13.6	152±4.2	1.88±.027	2.87±.08	0.097±.005	0.15±.004	0.63±.013	0.96±.0[illegible]
Differences of averages		639.0	171		2.88		0.45		1.21
T values[2]		42.9[4]	23.9[4]	2.67[3]	15.8[4]	15.8[4]	28.1[4]	1.62	15.9[4]

[1]Standard error.

[2]T values computed for 6 degrees of freedom.

[3]Significant—below the 5 per cent level.

[4]Highly significant—below the 1 per cent level.

presence became evident as soon as the seedlings reached the point where growth depended upon normal physiological processes rather than on food materials stored in the seed. No data are available regarding the spread of mycorrhizal fungi through the soil but it is believed from observation during the latter part of the growing season that the size of the infected spots increased. All the roots possessing mycorrhizae were profusely branched, had a large number of absorbing short roots, and the mycorrhizal short roots showed multiple dichotomous branching. The net result was apparently a much larger and more efficient absorbing system than was available to the non-mycorrhizal plants.

Summary

At Ames, Iowa, a new nursery was established on an area that had previously been farmed for many years. In this nursery various species of conifers including a number of pine species were planted on a sandy loam soil having a pH of 6.0 to 6.2. Four species of pines were mulched with pine needles taken from a nearby plantation. In the middle of the first growing season many of the pine seedlings turned brown to reddish purple in color while certain spots in the beds retained their normal color. The normal seedlings continued growth but the others ceased growth almost entirely. Upon investigating the roots of the trees it was found that mycorrhizae were uniformly present on all the seedlings that were normally colored and had continued growth, while the stunted seedlings lacked mycorrhizae.

Attention was concentrated on Virginia pine (*Pinus virginiana* x Miller) in obtaining quantitative data and attempting to define the relationships involved. Samples of mycorrhizal and non-mycorrhizal seedlings were taken and analyzed for green and dry weight, height growth, and amount of nitrogen, phosphorus, and potassium present in plant tissues.

It is concluded that the differences in plant development were due to differences in the availability of phosphorus and that the mycorrhizae had been the agency which enabled the affected seedlings to absorb this element at a more rapid rate than the non-mycorrhizal plants. The data obtained support the mineral nutrition theory of mycorrhizae of Stahl (9) and Hatch (3).

No information was obtained as to the specific fungi involved in the mycorrhizae formation but it is believed that they were introduced with pine needle mulch taken from a vigorous plantation in the vicinity of the nursery.

Literature Cited

1. Association of Official Agricultural Chemist. 1930. Methods of analysis. Washington, D. C.
2. Hatch, A. B. 1936. The role of mycorrhizae in afforestation. Jour. For. 34:22-29.
3. ————. 1937. The physical basis of mycotrophy in Pinus. Black Rock Forest Bul. No. 6.
4. Hatch, A. B. and K. D. Doak. 1933. Mycorrhizal and other features of the root system of Pinus. Jour. Arnold Arb. 14:85-99.
5. Melin, E. 1925. Untersuchungen über die Bedeutung der Baummykorrhiza: Eine Okologisch—Physiologische Studie. Gustav Fisher, Jena. Translated by Paul W. Stickel. 1930, Edwards Bros., Ann Arbor, Michigan.
6. Mitchell, H. L., R. F. Finn and R. O. Rosendahl. 1937. The relation between mycorrhizae and the growth and

nutrient absorption of coniferous seedlings in nursery beds. Black Rock Forest Papers No. 10.

7. Smith, F. B., P. E. Brown, C. D. Hoover and H. C. Millar, 1937. The availability of phosphorus in some Iowa soils. Iowa State College Jour. Sci. 11:231-243.

8. Snedecor, George W. 1937. Statistical methods. Collegiate Press, Ames, Iowa.

9. Stahl, E. 1900. Der Sinn der Mykorhizenbildung. Jahrb f. wiss. Bot. 34: 534-668.

GREAT forests of 30 to 40 million years ago in the northwestern United States stand out in clearer perspective through a systematic study of fossil plant collections of the Smithsonian Institution by Dr. Roland W. Brown, Geological Survey paleobotanist. It is as if the climates of our country had been reversed from East to West. The type of woodland now found in the East covered great areas of Washington, Oregon, and Idaho during the Miocene geologic period, when the world's flora was taking on much of its present form. The ancient flora of the West. Dr. Brown reports, is in strong contrast to that found in the same regions today. It is due in part, he believes, to a probable changed distribution of rainfall throughout the year.

Dr. Brown studied the fossil flora from eleven localities and augmented the previously known forms with fossils collected by himself in Idaho and Oregon. He was able to add several hitherto unknown species of trees.

BRIEFER ARTICLES AND NOTES

Annual Meeting
Columbus, Ohio
December 15-17, 1938

American foresters will head for Columbus, Ohio, for the 38th annual meeting of our Society. Forestry has been coming into its own of late. Each year since 1932 there has been some outstanding development or achievement to give point and emphasis to the annual get-together. This year the Program Committee has sought to relate the meeting to the Congressional Joint Committee on Forestry, and in addition to recognize the fact that the meeting place is the geographic center of several land-management enterprises which combine forestry with other activities.

The general theme for the first day's session is "A Workable National Forestry Program." The essentials of a forestry program will be outlined by G. H. Collingwood. The facts of our national timber stand will be discussed by R. D. Garver. The cooperative approach in forestry will be appraised by Charles A. Gillett. The practical problems of securing better management by private owners will be discussed by William L. Hall. And a federal plan of regulation in the democratic pattern will be presented by F. A. Silcox.

On Friday there will be a business session in the morning and in the afternoon a number of papers describing "Milestones in Forestry." The social and economic effects of the Great Plains Shelterbelt, the cooperative completion of the Pacific Northwest Regional Planning Report, and other timely subjects will be presented by Society members who have been vitally concerned.

On Friday evening there will be a foresters' dinner for members, their wives and guests, to be presided over by one of the Society's leading raconteurs. There will be no speeches, but the local Section has promised to turn some of its most talented dramatists loose on an assignment to furnish entertainment that will be topical and timely.

Saturday will be a day for Central States forestry and will include discussion of the place of forestry in soil and water conservation by Willis M. Baker; integration of wildlife management with forestry in the Central States by V. H. Cahalane and Lawrence E. Hicks; a survey of the farm forestry problem of the Central States and a paper describing the organization of the Ohio Valley flood control program by a farm forestry authority and an Army engineer. It is expected that one of the highlights of this session will be a review of the forestry problems of the Ozark region by Henry Koen. There will be ample provision for both prepared and extemporaneous discussion of all of these subjects, at all sessions.

Hotel Accommodations

All sessions will be held in the Deshler-Wallick, the official headquarters hotel.

Rates are quoted as follows:

Single rooms with bath: $2.50, 3, 3.50, 4, 4.50, 5, 6, 7.

Double rooms with bath: $4.50, 5, 5.50, 6, 7, 8, 9, 10.

Twin-bed rooms with bath: $5, 6, 7, 8, 9, 10.

Dormitory rooms for men with bath

and single beds: $2 per person for groups of four; $1.50 per person for groups of six or more.

Reservations should be made direct with the hotel management.

It is suggested that groups who desire dormitory rooms make up their own parties and request reservations at an early date.

Program for the Ladies

The entertainment for visiting ladies will start with a reception and dinner on December 15. On Friday morning they will be taken for a tour of an orchid farm, to be followed by a luncheon. In the afternoon they will visit the Ohio State University and the Columbus Gallery of Fine Arts.

Ladies are invited to the annual dinner Friday evening.

Saturday will be free of scheduled activities in order to allow time for shopping and theatre attendance.

A more detailed program will appear in the December issue.

Comparative Infiltration in Forest and Open

The importance of infiltration of water into the soil in forest influences and in hydrology may be claimed as justification for presenting another local but striking example. In the six years from 1932 to 1937 determinations of infiltration have been made each year in October on the top of a ridge just east of Berkeley, California which forms the south boundary of the University property. The area has a west exposure and a slope of about 25 per cent. A fire break some 40 feet wide has been cleared of vegetation by burning each year. Annual grasses and weeds come up each spring and dry out in April or May, although the roots have remained in the soil and decayed from year to year. The fire break has been used as a trail, and therefore has been subject to some trampling, although most of that has been concentrated in the trail proper, while the determinations of infiltration were made where there was no evidence of severe trampling. In October the mineral soil is directly exposed over more than 50 per cent of the area. On the remainder there is a sparse cover of the bases of dry grasses less than two inches high.

On the north, the fire break is bounded by a plantation of Monterey pine (*Pinus radiata*) 25 to 30 years old, having a crown density of 0.6 and averaging about eight inches in diameter and 35 feet high. Under the trees there is a complete forest floor one to three inches thick, but almost no subordinate vegetation. The experimental areas of a few square rods each on the open fire break and under the forest are less than 50 feet apart. Presumably the conditions before the pine was planted were as nearly identical as any two natural areas are likely to be. The soil is a silt loam underlain at depths of one to three feet by sandstone. It is evident upon examining the surface layer of the mineral soil in the two situations, that there are more holes and channels caused by macro-organisms in the area under the forest. However, most of the roots of the trees are more than six inches below the surface of the mineral soil. Volume weights of the upper two inches of mineral soil in the forest averaged 1.12 and in the open 1.38. If the specific gravity is assumed to be 2.6, then by calculation the pore space under the forest was 57 and in the open 47 per cent. Loss on ignition was 7.04 and 7.13 per cent respectively. The moisture content of the same layer in the forest averaged from seven to eight per cent and in the open from two to three per cent. Twenty-four hours after a heavy rain in March, the average moisture content under the forest was 26.8 and in the open 24.7 per cent. Temperatures at one inch depth in the afternoon at the time of making the deter-

minations were less than 70° F. under the forest and over 90° F. in the open.

In the six years, 337 paired determinations of infiltration under the two conditions of cover have been made by the method suggested by Auten.[1] The determinations under the forest were made after scraping away the forest floor. For the whole series, the average number of milliliters entering the soil in ten minutes has been 1,341 in the forest, and 338 in the open. The ratio of forest to open is 3.96. In individual years that ratio has varied from 1.9 to 4.6 The difference between forest and open is 1,003 milliliters, which is about ten times the standard error of the difference. The possibility is therefore extremely remote that the difference is a matter of chance. The absolute volumes for either situation, as Auten has pointed out, have little value because the method of application, by means of a nine inch head of water maintained in a pipe inserted one inch into the soil is very different from natural rainfall. It has not been proved, however, that the comparison between localities by this method may not be valid or at least reasonably indicative of actual differences.

The excess of infiltration under the forest seems to be largely attributable to the influence of the forest cover. The one factor which, in the open, is not naturally associated with the lack of forest is the trampling, and this would tend to make the infiltration slower on the fire break. However, it seems doubtful whether so large a difference could be ascribed to this cause. Otherwise the forest plantation seems to be the cause of the difference directly or indirectly. The higher temperature would tend to make the infiltration in the fire break more rapid, but it is actually much slower. The forest contributes organic matter to the surface as forest floor which doubtless reduces the impact of the rain and tends to lessen the movement of sediment by surface runoff. There is evidently more animal life in the soil under the forest, presumably because temperature, moisture and structure are more favorable. Large holes were avoided in making the determinations, but the greater abundance of smaller ones doubtless facilitated increased infiltration. The amount of incorporated organic matter is not significantly different. The formation of channels by the roots may favor greater infiltration under the forest, although a difference in favor of the forested area in this respect was not evident. The higher moisture content under the forest results partly from reduced evaporation and partly from fog drip. However, this would not necessarily favor infiltration because it was determined that the infiltration rate during the first one to three minutes of the ten-minute period of application was distinctly more rapid than during the remaining time when the soil was wet. Apparently, the infiltration slowed down as the pores in the soil adjacent to the end of the tube became filled with water. After the first three minutes, the rate of infiltration remained constant or decreased only slightly.

On the whole, the four times more rapid infiltration under the forest appears to be caused chiefly by the indirect influence of the forest canopy and floor in favoring the development and maintenance of a more porous structure consisting in part of channels of macro-organisms. Moreover, the foregoing comparisons seem to provide a strongly substantiated example of the influence of the occupation for 25 to 30 years by a pine forest plantation in increasing markedly the rate of infiltration of water into the soil.

Joseph Kittredge, Jr.,
University of California.

[1]Auten, J. T. Porosity and water absorption of forest soils. Jour. Agr. Research 46:997-1014. 1933.

Survey of Soil and Water Conservation and Flood Control in Foreign Countries

Dr. Walter C. Lowdermilk, chief of soil conservation research in the Soil Conservation Service, has been assigned to make a survey of the experience of certain European and Mediterranean countries in land utilization, with special reference to erosion control, soil and water conservation, and flood control problems in the United States.

He will examine the results of past and present land utilization of old countries so as to make available to the U. S. Department of Agriculture, and to cooperating state agricultural experiment stations and action agencies, information to aid in developing research and action programs. The aim is to profit by the experience and science of older countries, as well as by that of the United States, to develop ahead of the forces of destruction the most effective methods of conserving soils and waters and of controlling floods in the interests of a sustaining and permanent agriculture.

Information on the following general subjects will be sought in the countries named:

On soil conservation practices, methods of erosion control, and other means toward permanency in agriculture in England, Holland, France, Germany, Russia, Switzerland.

On torrent and flood control, water yields, and hydrology in their relations to land utilization in France, Switzerland, Germany, Austria, Hungary, Italy, Turkey, Russia.

On effects of land depletion through erosion and silting, and relation of erosion to remains of former civilizations and systems of agriculture that reduced productive regions to denuded wastes, in Greece, Sicily, Crete, Palestine, Syria, Turkey, Iraq, Iran, Persia, North Africa, Georgia (Russia), India.

Wolf Packs

In the January 1938, number of *Ecology* Sigurd F. Olson gives conclusive evidence that wolves in the Superior-Quetico area of northern Minnesota and Ontario run in packs numbering from 5 to 30. The smaller packs are families with last summer's pups; the larger are composed of several families banded together for better hunting, when game is scarce. Each of these packs follows a well-defined roughly circular or elliptical route, covering on its axis up to 100 miles. The pack may cover from 20 to 40 miles a day extending its range and speed in periods of starvation. The route is covered every three weeks with great regularity and evidence shows that the same routes have been followed for generations. Predatory control consists of locating these routes especially where they cross divides, and trapping in those localities. This system of hunting developed by wolf packs is highly efficient in the balance of nature because of its wide area and the element of surprise when the raids are followed by periods of complete absence of molestation. Several years ago the reviewer listened to a popular lecture by an arctic explorer who, in addition to an assertion that Eskimos never used snow huts, had very positive ideas to the effect that wolves never ran in packs larger than the family of the year. He therefore welcomes the scientific evidence contained in this article as settling this latter question.

H. H. Chapman,
Yale School of Forestry.

Direct Seeding in the Northern Rocky Mountain

The silvicultural advantages of direct seeding over planting of nursery-grown seedlings and transplants have long been recognized by foresters. Direct seeding

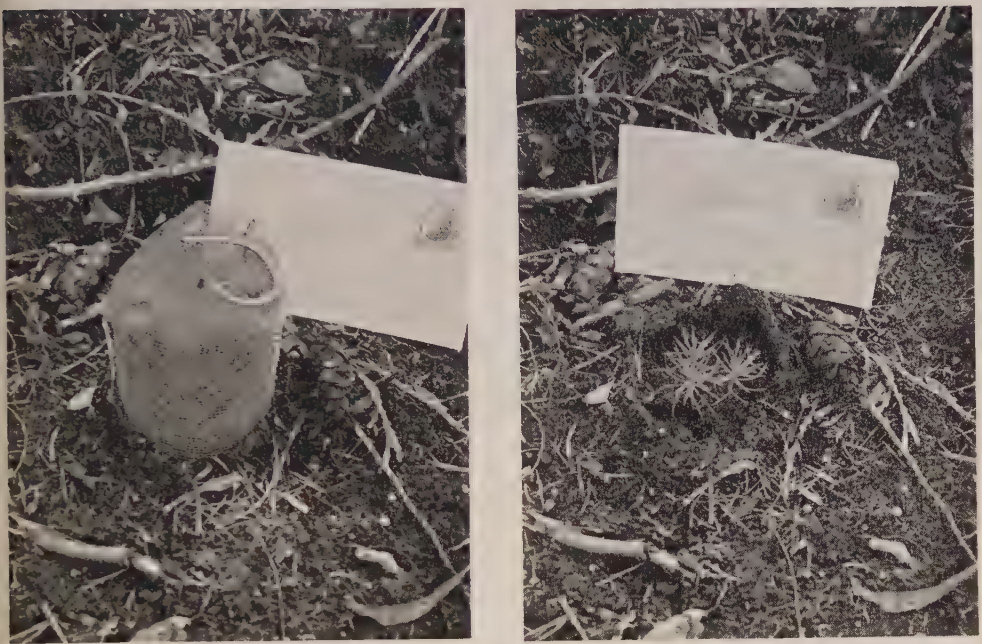

Fig. 1.—A fall planted seed spot of *Pinus monticola* protected from rodents with a wire screen. Both pictures were taken at the end of the first growing season.

Fig. 2.—A Hotkap seed spot. The picture on the right shows the original cap the first fall after seeding. The picture on the left was also taken in the fall with a new cap to show how the spot appeared immediately after seeding. The Hotkaps are opened up as soon as the young seedlings have cast their seed coats.

not only gives seedlings, and later trees, a normally distributed root system but allows a natural selection of genotypes and an expression of dominance which does not exist under a system of intensive nursery production. Since seed can usually be collected near the site to be reforested, there is little chance of using a geographic strain not suited to the area.

Silvicultural desirability and practical application, however, do not always run hand in hand, and suitable methods of direct seeding for the majority of our species and conditions have yet to be devised. This lack of knowledge is a natural stagnation from the chaotic direct seeding boom of 1911-1913, in which a bare 6 per cent of all seedings were successful or even partially successful.

It is felt by many that in spite of these and other failures direct seeding still holds possibilities and that local experimentation may yet place it on a sound basis for practical reforestation.

Preliminary experiments at the Miller Experimental Forest of the University of Idaho indicate that the use of screens and other devices for rodent protection may allow successful reforestation by direct seeding at a cost equal to or below that for planting. Fall-seeded spots of *Pinus monticola* protected by screens showed a first year establishment of 76.3 per cent with an average of 1.6 seedlings per spot. This compares very favorably with the average establishment at the end of five years of less than 50 per cent for all plantings in Region 1 (Northern Rocky Mountain Forest and Range Experiment Station Annual Report for 1936 and Program for Fiscal Year 1938). It must be recognized, of course, that 1937 was a very favorable year for both direct seeding and planting.

Spring seeding of previously stratified seed with rodent protection gave comparable results. Early spring seeding of stratified seed under Hotkaps (a commercial plant forcer manufactured by Germain's Seed and Plant Company of Los Angeles) also showed promise. The Hotkaps partially solved the rodent problem by giving protection from the Columbian ground squirrel but not from field mice. Their chief advantage, however, was in inducing early germination and subsequently giving larger, stronger seedlings to withstand the hot summer drought period. Damping off did not occur in spite of the warm humid atmosphere prevailing under the "caps".

These results are encouraging and further studies with other species as well as with other techniques and more economical protectors are in progress.

SELDEN L. TINSLEY,
University of Idaho.

IS SPRING OR FALL THE BETTER PLANTING SEASON?[1]

The relative merits of spring and fall for planting in the Lake States have been investigated in a comprehensive experiment carried out on the Superior National Forest by the Region in cooperation with the Station. The results of this experiment offer the most conclusive and convincing evidence for the belief that spring is the better season for planting operations, at least on the Superior National Forest.

This experiment was conducted at eight different C.C.C. camps on the Superior. The stock used was 2-0 red pine and the planting was done in the fall of 1935 and spring of 1936.

Planting was done on light, medium

[1]Technical note 131. Lake States Forest Experiment Station. Maintained by the U. S. Department of Agriculture in cooperation with the University of Minnesota.

and heavy soils and under three degrees of cover. The different soil and cover conditions were represented equally in both the spring and fall plantings. The results to be discussed below may be considered statistically significant and conclusive.

On all three soil classes and cover densities, spring planting resulted in better survival; twice as good on the average, in fact. On heavy soils, spring planting was nearly six times as good. With spring planting, survival increased with the change from light to heavy soils, while for fall planted trees, survival was considerably lower on heavy soils than on light and medium.

It should be understood that these results are from only one year's plantings. However, the fall season in which the planting was done was favored by conditions better than average, while the spring season was immediately followed by the severe drought of 1936. Furthermore, the evidence from this experiment is supported by that from several other less extensive tests, so it would seem reasonable to expect as great or even greater differences in the same direction in other years.

The facts learned from this experiment can be literally translated into recommendations to be followed when drawing up planting plans. First, as much of the planting as possible should be done in spring; second, what planting is done in the fall should be confined to light and medium soils.

Forestry Education in Finland

The first school of forestry in Finland was established in 1858, and this school remained open till 1908, when it was transferred to the University of Helsingfors. The ordinary course lasts three to four years, but advanced students may be under training for six to eight years.

There are at the University 300 forestry students and 600 agricultural students and the joint faculty has thirty professors and many pupil teachers. In the first year 150 students compete for sixty forestry studentships. The output of trained foresters is twice that of Sweden, and up to date all have obtained employment. A number are employed by sawmills, banks and other bodies interested in forestry and the timber trade, and as a general education the course is highly esteemed.

(*British*) *Empire Forestry Journal.*

Erratum

In the article "The Development of Decay in Living Trees Inoculated with *Fomes Pinicola*," July Journal of Forestry, on page 707, the third figures in columns 7 and 10 of Table 1 should read respectively 18 and 56 instead of 1.8 and 5.6.

Chronica Botanica

A new international bimonthly for quick publication of botanical material has been established as *Chronica Botanica, International Plant Science Newsmagazine.* The *Chronica* is to note the results of recent research and new discoveries, to provide critical discussions of important publications, and to present scientific discussions of topics of current professional interest. In addition it will give notes concerning personnel engaged in various types of botanical activities, activities and news of societies, and information on the establishment and operation of new institutions or new work.

The field of work of *Chronica* includes forestry, horticulture, botany, and agronomy.

Chronica Botanica as a bimonthly is new. As an annual it is three years old. In these three annuals, it has published notes on the activities of various botanical research and educational institutions throughout the world, news relating to personnel, and information on meetings, etc. However, *Chronica Botanica* is now being issued as a bimonthly journal. *Chronica* has reviewed the shelterbelt project, reorganization of the federal government especially in its relation to forestry, and several publications.

Chronica Botanica is also sponsoring a new series of plant science books. Five of these are already announced includi[illegible] three in the forestry field: *Forest Tr[illegible] Seed*, by Dr. H. I. Baldwin; *Tree Grow[illegible]* by Dr. D. T. MacDougal, and *Wood Pu[illegible]* by Julius Grant.

The editor of *Chronica Botanica* is [illegible] Frans Verdoorn of Leiden, Holland. T[illegible] staff assisting him is composed of edit[illegible] selected from a wide array of interest[illegible] scientists throughout the world. F[illegible] members of the advisory editorship [illegible] Americans. Two foresters are represent[illegible] on the staff—Professor F. Heske of G[illegible]many and E. N. Munns of the Unit[illegible] States. The subscription price is 7[illegible] guilders a year, postpaid (about $4.30[illegible]

E. N. MUNNS,
U. S. Forest Service

REVIEWS

We Too Are the People. By Louise V. Armstrong. *474 pp. Little, Brown and Co., Boston. 1938. Price $3.*

During the past five years many foresters have participated in relief projects; usually their activities have consisted of laying out or supervising these projects. Perhaps they were little interested in the working of the agencies that supplied the labor and often inclined to criticise the complex rules under which it was furnished.

Mrs. Armstrong was for three years Federal Emergency Relief Administrator in Manistee County, Mich., a lake-shore county in the upper part of the Lower Peninsula. She paints a graphic picture of the relief work in her county, both on its organization and on its human side, which goes far to explain some of the difficulties encountered and the constructive results, both for the recipients and through the work projects.

This book should be especially interesting to foresters because this county was timber-mined years ago, and besides the difficulties of the depression itself there were those of a region left economically prostrate after the sawmills had cut their last logs. The author is conversant with this fact and particularly with its social consequences. She paints a picture of a small city with an upper social stratum left over from the lumber-baron days, living on a gradually declining income, trying ineffectually to "bring in new industries," but still able to maintain itself in political control, largely indifferent if not passively hostile to the constructive work, both material and human, which the relief agencies and the work projects, many of them forest projects, were attempting. She shows a shop-keeping class hard hit by the gradually diminishing purchasing power, but managing to keep going. There were a few prosperous farms in the back country where there was good soil, but there was little of that compared to the vast areas of cutover land producing nothing and populated by a collection of derelicts from the logging days, some "suckers" who had bought sand farms and been too poor to move away, drifters who squatted in the region, many from the South and a few from the cities, and last, the remains of the Ottawa Indians. All were gradually degenerating from lack of opportunity to earn a living and existing in such poverty that she says "many of them did not know that there was a depression."

Her reaction to the generality of the upper stratum and their political henchmen in all the lower groups was that of one who had to fight off their constant attacks on the state and federal relief administrations, which were actuated by the hope of gaining local political control of the funds to spend as they pleased. As a professional social worker, she fought as hard for the integrity of her work and that of her staff as foresters have often had to fight the same sort of attack.

To her mind all but a few of the people on relief, and those mostly the degenerates in the "badlands," were able and desirous of working. She pays high tribute to assistance from the federal forest officers and to the constructive value of their projects, whether C.C.C. or others.

She does not raise the question whether the relief she administered can have permanent value for the inhabitants until the new forests come into production and thus give the country a new economic

base. Such a base might not have rendered Mrs. Armstrong's work unnecessary in a national and world-wide depression, but it would assuredly have made it easier and far less costly in human suffering and in dollars.

P. L. Buttrick,
University of Georgia.

Famous Trees. By Charles E. Randall and D. Priscilla Edgerton. *U. S. Dept. Agric. Misc. Pub. 295. 116 pp. Illus. 1938. 15 cents.*

Many an ardent conservationist has had his first interest in forestry stimulated by an individual tree.

It is always noteworthy to observe the proprietary regard, even affection, shown by many communities in local trees which by reason of their historical, religious, or literary associations, unusual size or age, or other outstanding characteristics, are often living objects of great local pride. It is perhaps no exaggeration to assert that much of the public support of the nation-wide reforestation and forest protection movements has stemmed from the cumulative interest of thousands of citizens in hundreds of communities in their local "famous" trees.

In view of this widespread interest in individual trees, it is a legitimate—in fact, a desirable—function of foresters to promote forestry by focusing attention on the role of trees as good citizens. Support of conservation comes from all kinds of people. And, as the authors of this excellent booklet significantly point out, "Trees are loved by all kinds of people."

How the individual trees came to win such an important place in human experience is aptly summed up in these brief sentences: "Trees by their very nature are landmarks and memorials. They are therefore identified with human happenings. Also, trees, having more than the allotted span of man, carry their associations through generations of men ar women. Thus they often figure not on in biography, but also in history."

Famous Trees is a delightful booklet delightful alike to read or merely browse through. It contains a wealth information, tersely and simply writte Hundreds of notable trees, located in a most every state and members of man species, are described. Doubtless th authors will be criticized for omitting a few obscure favorites, but generally th reader will be amazed by the complete ness of the record.

The booklet is divided into two ma parts: trees associated with notable pe sons, events and places; and trees notab for unusual size or age. They are d scribed under the states in which they a located. Fifty illustrations are used. Th bibliography appears to be unusual complete, with 105 literature citation The format is particularly pleasing an the paper stock is of exceptionally go quality for a government publicati priced at 15 cents.

In subsequent editions, or should t booklet be revised, it is respectfully su gested that an index be inserted.

Henry E. Clepper.

Mechanical Properties of Certa Tropical Woods, Chiefly fro South America. By William K noch and Newell A. Norton. *Uni of Michigan School of Forestry an Conservation Bull. 7. 87 pp. 3 fi 1938.*

With an estimated reserve of 6,000 bil lion board feet of hardwood timber avai able for local use or export from Centr America and the Amazon Basin alone, is to be expected that increasing amoun of lumber from the tropics will compe with our domestic hardwoods. As De Dana has stated in the foreword, "Trop cal woods are bound to be of increasi

importance to this country as the forest resources of Central and South America are more fully utilized and their products enter more generally into the world markets for lumber. Whether they are regarded as unwelcome competitors or as desirable supplements to our waning supply of certain species, accurate information as to their properties is urgently needed."

The authors have given us this information for about 40 tropical species in as complete detail as could be expected for a pioneer survey, a survey in which they follow with fidelity the procedure which has been standardized for similar studies in all parts of the world. Although this study is preliminary in character, every precaution was taken to establish the identity of the species tested—no easy task with any research dealing with tropical timbers. In spite of the fact that in many instances they had material from only a single tree, and rarely from more than three, the paucity of sample trees should not militate against the value of their results. This contention is supported by the fact that the Madison Laboratory has established statistical constants which are available for the evaluation of such data. To be sure, the study is not complete even in scope, since, as the authors suggest, the drying properties, workability, volume available for a continuous supply, cost, etc., await further research before the full story can be told. The main purpose of the present survey was to select, by means of standard strength analyses, those species which give sufficient promise to justify more extensive and hence more costly investigation. This goal has been attained.

Following the usual practice, the authors have prepared tables which record specific data for each species tested, both green and air-dry. By comparing these data with similar data on our native woods, it should be possible to align these tropical woods with those of our native species which exhibit comparable properties. However, in several instances such direct comparisons are impossible because some of the tropical woods tested were extremely heavy. Nevertheless, the information is of value, for it extends the range of the strength-density relationship. Owing to lack of equipment, the impact test was omitted; otherwise the procedure was standard, not only in the selection of "perfectly clear" small samples, but also in the mechanics of testing and the subsequent calculation of values.

It might be added in passing that this bulletin presents a very clear picture of test procedure, supported by numerous specific and pertinent references. It also contains brief descriptions giving the geographical source, appearance, and general properties of the woods examined, together with statements as to their value in utilization where such information is available. A table listing the woods by weight classes, together with a parallel classification of native species, is included.

The first part of the paper concludes with a critical analysis of the data for 38 species, and a detailed discussion of those which warrant further investigation. These include mahogany (*Swietenia spp.*), tanguile (*Shorea polysperma*) from the Orient; saqui-saqui (*Bombacopsis sepium*) from Venezuela; duka (*Tapirira spp.*) from British Guiana; pardillo (*Cordia alliodora*) from Venezuela; imbuia (*Phoebe porosa*) from Brazil; white cedar (*Tabebuia longipes*) from British Guiana; iroko (*Chlorophora excelsa*) from West Africa; icaquito (*Licania hypoleuca*) from Venezuela; pau amarello (*Euxylophora paraensis*) from Brazil; macacahuba (*Platymiscium ulei*) from Brazil; roble (*Platymiscium polystachium*) from Venezuela; pau roxo (*Peltogyne densiflora*) from Brazil; morabukea (*Mora gonggrijpii*) from British Guiana; sucupira (*Bowdichia brasiliensis*) from Brazil; greenheart (*Nectandra rodioei*) from British Guiana, and gateado (*Astronium

graveolens) from Venezuela.

The second part of the paper consists of a more exhaustive study of five species: cativo (*Prioria copaifera*) from Panama; carbonero (*Piptadenia pittieri*), balsamo (*Toluifera balsamum*), bosuga (*Fagara monophylla*), and trompillo (*Guarea trichilioides*) from Venezuela. This analysis comprises not only general descriptions of the woods, but also descriptions of their microscopic structure and its relation to the strength properties of the different species.

In order to make a more precise comparison with native woods, the mechanical values have been adjusted to a 12 per cent moisture content, following the procedure developed at the Forest Products Laboratory.

The 87 pages of text in no way measure the work which has been required to make this bulletin possible. Arrangements had to be made for the collection of material by competent field men in West Africa, the Philippine Islands, and eight South and Central American countries. In this phase of the work and the later investigation, the authors were aided by the University of Michigan and the Tropical Plant Research Foundation and the Wood Industries Division of the American Society of Mechanical Engineers. After the material had been received, blocks for 30,000 tests had to be prepared with the precision necessary for such studies; each one had to be tested individually and the results recorded, tabulated, analyzed and correlated in such a way that the salient points might be available. The writers deserve commendation for their diligence in assembling the data, and congratulations for the manner in which the results have been presented.

The bulletin will be of value not only to those who are concerned with the utilization of tropical woods, but also to anyone interested in wood technology.

C. C. FORSAITH,
New York State College of Forestry.

If and When it Rains. By F. E. Mollin. *American National Live Stock Association. 60 pp. Illus. 1938.*

This pamphlet is a "plea for more practical and less theoretical consideration of problems affecting the western ranges" and appears to be an effort on the part of the above association to offset the findings of the Forest Service on overgrazing as published in Senate Document 199, 74th Congress, entitled *The Western Range.* Its basic contention is that rain is the primary factor governing the relative abundance of forage, and that, by and large, there has not been overgrazing or abuse of the range.

The booklet is of great interest to foresters and scientists as a typical illustration of the dependence of organizations, having a direct interest in an economic subject, on arguments and facts drawn from personal observation and experience, not checked or verified by sound scientific investigations. The process of selection of evidence to justify a contention, also widely employed in propaganda, is here strongly shown.

The contentions that droughts of the past were as severe as those of more recent date, and that forage varies with rainfall are basically sound. Where empirical testimony falls down is in not determining or accepting facts derived from painstaking, accurate, and unprejudiced studies of plant successions, water table, and erosion, in their temporary and permanent effects on carrying capacity of the range.

It would appear that a great industry such as represented by the western live stock interests would desire as much knowledge of these basic facts as possible instead of regarding any findings which indicate overgrazing as directed against the industry, instead of seeking its permanent establishment. The catchword "theoretical" is set up opposite the word "practical" much as the last generation of dirt

farmers used to talk with regard to the agricultural experiment stations and their scientific investigations.

With the more valuable forage plants badly depleted or in places practically exterminated by overgrazing, and lower and less valuable plants in full possession over wide areas, the range cannot on the whole be restored by any theoretical assumption that rain alone is the deciding factor, any more than farms whose top soil was blown away during the drought years can be restored to full productivity merely by rain. Rain, accompanied by wise range management, may rejuvenate in part the less damaged areas. Rain, without such management, will result merely in increased erosion and another wave of overstocking and overgrazing.

This booklet appears to the reviewer as a striking illustration of the reasons why any industry dependent on the use of irreplaceable national resources should not be permitted to run its affairs wholly on the principle of *laissez faire*, and thus to ruin those resources through shortsighted overuse and the struggle for profits at the expense of conserving the soil and its productiveness.

H. H. Chapman,
Yale School of Forestry.

Eighteenth Annual Report of the Forestry Commissioners for the year ending September 30th, 1937. *50 pp. H. M. Stationery Office, London, 1938.*

Problems in different countries run parallel and show striking similarities in fundamentals, differing only in so far as each nation's institutions, viewpoint, and physical conditions differ from those of other nations. Since a large part of American institutions had their roots in those of England, it is but natural that not only the problems but the methods of attacking them should have a good deal in common.

The outstanding forest problem in Great Britain, as in America, is the privately owned forest. Of far less economic importance, but much more in the public eye, at least in Great Britain, is the question of recreation.

It was expected, when the Forestry Commission was set up, that public and private effort in forestry would go along together; that while the public was buying and planting land for future forests, private owners would not merely restock the areas cut over during the war, but extend them. Although the public has done most of its part in spite of severe financial difficulties, the private owner has fallen far behind, even with tax concessions and generous subsidies. Yet "nine-tenths of the woodland area and an even greater proportion of the standing timber of Great Britain are in private ownership," a condition, so far as proportions go, not greatly unlike that in the United States.

The Forestry Commission has, quite naturally, put most of its effort and money into acquiring and planting land for government forests, devoting to private forestry such amounts as it appeared should be sufficient to encourage the owners. Thus in 1937 the expenditure for forestry operations (acquisition, planting, administration, etc.) was $4,167,000, for planting subsidies $60,375, grants for education $51,475, and for advisory services only $6,590.

It is now recognized that the encouragement provided has not evoked the expected response, and that something further has to be done to remove the real and imaginary obstacles which interfere with forestry practices by private owners. The first step is to show that forestry pays, and the movement to improve the marketing of home-grown timber, in which the Forestry Commission is actively co-

operating, has already been described.[1] Further measures, already started or in contemplation, are mentioned by the commission in this report.

Last summer, in order to overcome the shortage of foremen with a knowledge of simple forestry, courses of three months' practical work were given, with the assistance of the Royal English and Royal Scottish Forestry Societies, in three places in England and two in Scotland. In February 1938,[2] the Commission held a conference with representatives of all interested groups. Definite proposals were made which the Commission agreed to put into effect. Among them is an advisory service for England and Wales, to be started on an experimental basis. There are not enough professionally trained foresters to cover the area, and a certain amount of doubt exists as to whether enough owners would use the service to justify the expense. Undoubtedly, if the necessary number of men were trained and if the interest of the owners were aroused, a great deal could be accomplished, as it is by extension forestry in the United States and by the agricultural advisory service which is well developed in Great Britain. The conference considered public regulation, and, although not recommending it at the present time, did not exclude "the possibility that in the national interest it might at some time be necessary to exercise some form of control over private woodlands."

Recreation, generally considered from the scenic point of view and hence known as amenity, appears to be the most difficult problem, so far as the public at large is concerned, with which the Forestry Commission has to contend, and that for reasons which an American finds it difficult to understand. The plans for planting land acquired by the Commission in the Lake District, one of the best known scenic areas in England, have aroused a storm of protest. It is as if the National Park Service planned to put up billboards in the Yellowstone. Numerous letters in the *Times*, and meetings between the Commission and representatives of public bodies, have finally resulted in an agreement whereby a specified sum is to be raised by public subscription to reimburse the Commission for leaving unplanted a certain area and thereby protecting the scenery from desecration. The aim is to preserve the bare and rugged outlines of the glens and mountains which would, it is true, be radically changed if the slopes were forested. In the New Forest (set aside by William the Conqueror) a survey has been made "of a number of subjects, such as rides, bridges and drains, and *the spread of seedling pines, about which complaint has been made*" (the italics are mine). The report says that the Commission's operations "continue, in England and Wales, to attract a fair share of criticism." The explanation is that in a small country almost every acre has economic or sentimental attraction in somebody's eyes, and "changes in familiar surroundings are seldom welcome." The Commission even finds it necessary to remind its critics of the reason for its own existence and of the part which home-grown timber played in the last war.

The Commission is doing its part toward meeting the growing need for outdoor recreation by forming National Forest Parks. The first of these is in the Argyll area, and others are under consideration.

The total area acquired by the Commission is 558,685 acres, as compared with 676,400 proposed. The total of 316,548 acres planted exceeds the minimum area proposed. The total expenditures for 18 years of $40,658,630 are $3,931,420 below those proposed. The expenditure in 1937

[1]Moore, Barrington. The development of cooperative marketing and forestry in Great Britain. Jour. Forestry 35:439-447. 1937.

[2]Mentioned in the report, though later than the period which it covers.

was $4,559,730 and the receipts, which include those from the Crown Forests transferred to the Commission, reached $1,140,395, a large amount when it is considered that the oldest plantations are only just reaching the stage of their first thinnings. Whether or not the government's forestry enterprise will fulfil its primary purpose of a timber supply for national defense depends on how soon it will be needed, but it is pretty certain to yield a handsome and welcome revenue.

BARRINGTON MOORE.

The Sawmill Industry in Scandinavia and Finland and the Exports of Sawn Softwood from these Countries. By Eino Saari. *London and Cambridge Economic Service Special Memorandum 42. 54 pp. 8 figs. London School of Economics, London. 1936. Price 5s.*

This comprehensive analysis of the lumber industry and timber trade of Norway, Sweden, and Finland should be of especial interest in connection with discussions of our own softwood timber trade with Great Britain.

In addition to describing the situation with respect to those three countries, it gives considerable information on the timber trade of the other exporting countries of eastern and southern Europe. The discussion of timber exports centers around the timber trade of the United Kingdom, which takes the lion's share of the sawn lumber exported from the northern countries as well as from Russia and Poland. About 3.3 billion board feet out of 7 billion feet exported by the five countries goes to the United Kingdom, and they supplied 77 per cent of Britain's softwood lumber imports from 1922 to 1935. In contrast, the United States supplied less than 4 per cent and Canada about 7 per cent. Sweden and Finland export 70 to 80 per cent of their lumber cut and have about reached the limit of sustained lumber production. Russia has not, but the percentage of the Russian lumber cut that is exported decreased from about 40 before the War to less than 20. This decrease has been accompanied by a tremendous increase in domestic consumption of lumber, from 3 billion feet before the War to almost 10 billion feet in 1933-1934.

It is interesting to note that Swedish sawmills get 25 to 81 per cent of their logs from their own forests (depending on the district), but that the Finnish mills buy 89 to 92 per cent of theirs from the state and from farmers. Another interesting statement is that the average size of sawlogs and the proportion of large-sized material are decreasing in both Sweden and Finland, in spite of the growing use of timber for pulp. One might infer that this indicates overcutting, though the official statistics show a slight excess of increment. The small average size of the timber is shown by the fact that in Sweden only 60 per cent of the growing stock of pine is saw timber (trees 8 inches and up in d.b.h.), and only 2.4 per cent of the saw timber is in trees of 18 inches or more.

W. N. SPARHAWK.

The Cambium and Its Derivatives. X. Structure, Optical Properties and Chemical Composition of the So-called Middle Lamella. By T. Kerr and I. W. Bailey. *Jour. Arnold Arboretum 15:327-349. 1934.*

The Visible Structure of the Secondary Wall and Its Significance in Physical and Chemical Investigations of Tracheary Cells and Fibers. By I. W. Bailey and T. Kerr. *Jour. Arnold Arboretum 16:273-300. 1935.*

The Structural Variability of the Secondary Wall as Revealed by "Lignin" Residues. By I. W. Bailey and T. Kerr. *Jour. Arnold Arboretum 18:261-272. 1937.*

The Orientation of Cellulose in the Secondary Wall of Tracheary Cells. By I. W. Bailey and M. R. Vestal. *Jour. Arnold Arboretum 18: 185-195. 1937.*

The Significance of Certain Wood-Destroying Fungi in the Study of the Enzymatic Hydrolysis of Cellulose. By I. W. Bailey and M. R. Vestal. *Jour. Arnold Arboretum 18: 196-205. 1937.*

Cell Wall Structure of Higher Plants. By I. W. Bailey. *Ind. Eng. Chem. 30:40-47. 1938.*

The last several years have witnessed the enunciation of strikingly new viewpoints of wood structure. One phase of the attack participated in by I. W. Bailey and his coworkers has revealed much new information and valuable technics. An early study (Jour. Arnold Arboretum 15:327-349. 1934) reported the results of a searching examination of the middle lamella. On the basis of staining reactions, optical behavior, and chemical solubilities, the investigators concluded that the middle lamella consists of an inner layer of isotropic material and two lignified outer layers (anisotropic cambial walls) while the secondary wall has three distinct layers. The heterogeneity of nomenclature of these layers is pointed out and a standardized terminology is proposed. Evidence is offered to show why the authors believe the middle lamella contains pectic material. The work is profusely illustrated.

A later publication (Jour. Arnold Arboretum 16:273-300. 1935) presents a survey of secondary wall structure showing various types of cellulose structure and the interpenetrating structures of lignin, each continuous and forming an interpenetrating three-dimensional lattice. Fine photographs and splendid full-tone reproductions graphically illustrate the experimental observations. A subsequent report (Jour. Arnold Arboretum 18:261-272. 1937) offers further evidence on the structural patterns of secondary walls and variability of a given pattern in different parts of the stem of conifers and many dicotyledons.

Using a technic precipitating iodine crystals in the wall itself, the orientation of the fibrils in various lamellae, in the pit fields, etc., was shown (Jour. Arnold Arboretum 18:185-195. 1937). Enzymatic hydrolysis and erosion also demonstrated fibril orientation (Jour. Arnold Arboretum 18:196-205. 1937).

A recent paper (Ind. Eng. Chem. 30:40-47. 1938) summarizes these data and reviews the chief contributions such as the structure of the middle lamella, the primary and secondary wall, planes of structural weakness, and fibril orientation. The conclusion is offered that both the primary and the secondary wall are composed of a porous but firmly coherent matrix of anisotropic cellulose whose structural details extend to the limits of microscopic visibility. It is believed that lignin and other non-cellulose constituents may be deposited in the communicating interstices of the cellulose, resulting in two continuous, interpenetrating systems. If heavily lignified, either appears to be dissolved without rupture of the other. Structural patterns in the secondary wall vary widely; suggested causes include varying cellulose porosity, different micelle orientation, non-uniform distribution of non-cellulose material, and non-cellulose layers. This last paper presents an abbreviated but quite complete summary of several years' experimental work, is abundantly illustrated with photomicrographs of the important findings, and the investigators' interpretation of these observations.

A. J. Bailey,
University of Minnesota.

CORRESPONDENCE

A letter, dated August 8, signed by "A Junior Member" was received by the editor-in-chief. It was a comment upon the letter by Arthur D. Read printed in the August issue of the JOURNAL.

It is against the editorial policy to publish anonymous contributions in the JOURNAL OF FORESTRY. If the writer of this communication wishes it to be considered for publication, he is requested to identify himself; his name will be withheld, however.

July 28, 1938.

DEAR DR. SCHMITZ:

I note with half-amused and half-indignant interest the letter by Michael Pochan published in the May JOURNAL concerning the unemployment situation of young foresters.

May I, as a graduate of an eastern forestry school of last June, and now working as a logger with a large company on the Coast, present the entirely different views held by perhaps a small but at least determined group of recent graduates?

In contrast to Mr. Pochan's illusions, we were aware even at the time we were in school that forestry was in a tremendous inflationary period of governmental employment — how soon the bubble would burst was apparently only a matter of time. It so happened that the crash came just about when we graduated.

Briefly, the main objective of us who had hopes for real forestry in America — who really wanted to be foresters ourselves, and who still want to have our finger in the pie of modifying and overhauling the cockeyed and haywire forestry policies being practiced and advocated, which only the smug and idealistic won't admit exist—was finding a job, any kind, just so it would lead to future possibilities. Consequently, the majority of us who are working have migrated to private industry — for any kind of work related to use of forest products — logging, milling, pulping, or engineering. We think the greatest untouched field in forestry today is with private interests, who control eighty per cent of the remaining commercial timber. If we can become valuable enough to our companies in the future, we can probably then be an important factor in governing their forest policy. Who will say that this will not be an important factor in sound conservation in the future?

Cut down forestry school enrollment? Democratic principles of giving everyone a chance will not condone it. Beg and plead from the already well-known men of our profession for a handout? Where is our self-respect? We believe we can handle the situation ourselves.

Very truly yours,

AL KIRNAK,

Junior Member.

DEAR MR. GOOD:

I have read a copy of your letter to the Editor of the JOURNAL OF FORESTRY with a great deal of interest.

Probably I did not give sufficient weight to the point which you mentioned, namely, that the program industry considered was one covering only on "the forest lands in outside ownership." Possibly my reason for not emphasizing this point is

explainable on the basis that neither I nor the Forest Service have felt that there should be much, if any, distinction between the practices on company owned lands and non-company owned lands. These rules of practice are primarily concerned with conditions of timber growth, and I doubt if a tree knows who owns it.

Of course, there are practical aspects to be considered and undoubtedly they have been given due weight in the program at present in force.

If you had been present at the Mobile meeting, I am sure that you would realize that I have understated rather than overstated the case.

More than one industrial member present at that meeting stated voluntarily that if the Forest Service rules were to be put into effect that they would of necessity have to close down their mills and drop out of the picture. A forester prominent in the South has stated to me that he considered that the program your organization so ably launched at New Orleans received a set back of at least two years as a result of the Mobile gathering and I know this opinion is shared by others; however, I pass over this fact with the remark, "Industry tended to back away from a set of rules which, at first glance, seemed unnecessarily long and complicated. . . ." Actually, I doubt if we are far apart on our views of the situation.

I am writing to the Editor of the JOURNAL OF FORESTRY that he publish all, or part, of your letter of July 2nd in a subsequent issue of the JOURNAL in order that any unfortunate impression that my article may have created may be ameliorated thereby.

I am sure that the profession will be glad to have the additional observance that you will contribute on a situation which is of primary interest to all of us who are concerned with the stabilization of forest industries in the South.

N. D. CANTERBURY.

DEAR DR. SCHMITZ:

While following the Rocky Mountain-Big Thompson controversy in the JOURNAL, it seems to me that no consideration has been given the most far-reaching and basic question involved in the problem.

We all agree that no economic development should be allowed in a national park. Why then by the same tenets cannot we agree that any area needed for water storage, flood control, power development, or other economic necessities should never be included within a national park.

Colorado it appears needed, and knew that she needed, certain waters and projects appurtenant to those waters for the continued welfare and prosperity of her agricultural people on the eastern slope of the mountains.

Refusing the demands of the National Park Service and the hotel men that she relinquish these rights, Colorado was successful in protecting them in the original bill creating the park. The National Park Service took over this area well knowing that these rights were part and parcel of the bill creating the national park. These rights then should have been as inviolate from the Park Service as any scenic area within any park from other outside economic development.

Had the Park Service been sincere regarding park standards, they would never have accepted the area under the conditions imposed by the bill of 1915 creating the park.

Furthermore, how can Robert Marshall condone the political dishonesty back of the bill of 1921 which took away the rights given in the original bill of 1915. He completely ignores the righteousness of the bill of 1915, but proclaims the righteousness of the bill of 1921. The first had an honesty of purpose, openly debated and with no hidden ulterior motive written into its meaning. The second bill was political dishonesty in that by blanket legislation

it nullified the original rights of Colorado which, had they not been written into the bill, that part of the area would never have been included within the park boundaries.

Thus the first mistake was the inclusion within a national park of an area under controversy. The second mistake, and an unforgivable one, was the method by which the Park Service sought to deprive Colorado of its rights so necessary to the life of its agriculture.

Nor is this the first time we have witnessed such political dishonesty. Neither is it the last. Events are shaping today in California quite similar and even more ruthless.

While the National Park Service is fighting a bill to divert water from the Yellowstone, it is sponsoring a bill in California, which if successful will do just what they are trying to prevent in Wyoming. I refer to the proposed Kings River National Park bill, H. R. 10436.

By the terms of the bill the valley floors of the South and Middle Forks of the Kings will be divided into two parts. The lower portions, where storage reservoirs and power development will be constructed, will remain under Forest Service administration. The upper portions and 400,000 acres now a part of the primitive area set aside by the Forest Service will become a national park.

A three million dollar road is now being constructed by the state of California into this area, and the tourist will first pass the dam and power development, which as far as he can determine will be in a national park. A mere surveyor's boundary line will not convince the tourist that water storage and power development are not a part of national park policy. If in the Kings, why not water storage and power development in the lower portion of the Yosemite Valley.

With all of the oratorical eloquence and literary effusions expended during the last thirty years in an effort to create an idealism regarding national parks, and a reverence toward all great natural scenic beauty spots, the National Park Service is willing to scuttle all existing park standards for the purpose of expansion. Nor does it seem possible that the National Park Service would dare consider the Kings River Canyon other than a unit of scenery. But they are not only willing, but striving to carve out a portion of that unit for a national park, which by so doing will destroy that portion for national park purposes.

Of course the answer to this willingness to scuttle park standards is, as it was in the case of the Rocky Mountain National Park. Before storage reservoirs can be built at Tehipiti and Cedar Grove, and it will be a long time, the Park Service plans to annex these reservoir sites, now safeguarded to the irrigationists by the Forest Service, but very generously offered to them by the Secretary of Interior, even as they legislated away the rights of the irrigationists of Colorado.

When political dishonesty is leached from the methods and motives of the Department of Interior, then and only then can we hope for national park standards such as Muir and Le Conte dreamed of, and a National Park Service which practices the idealism about which they preach.

Ernest G. Dudley,
Exeter, California.

Dear Dr. Schmitz:

Mr. Dudley's letter appears to bring up no new points which have not been said in substantially the same words during the reams of literature which has been written on the Rocky Mountain Tunnel fight. The Tunnel fight has been won by those who wanted it and it hardly seems profitable to keep up the recriminations and counter-recriminations indefinitely.

Concerning Mr. Dudley's contention

that the Act of 1915 was righteous and the Act of 1921 unrighteous, I do not see that there is any point to be gained from such a valuation of relative morality. A law either is or is not on the statute books. If we had to divide all the laws into two sets, the righteous and unrighteous, I cannot conceive of any way out of the ensuing chaos, as everyone would regard the laws he liked as the righteous ones. After all, however much I may deplore the fact that Supreme Court decisions reserving for private property ownership rights which the Founding Fathers never intended it should have all stem from the due property clause in the Bill of Rights, nevertheless this clause is there and has been so interpreted, and my deploring will do no good until either it or the Supreme Court interpretation is changed. The same principle, it seems to me, is true about the Water Power Act of 1921, which I probably think was bad for far more serious ways than Mr. Dudley feels.

Mr. Dudley concludes with an unsupported sneer at the political dishonesty of the Interior Department. For what personal experience may be worth, I have served in the conservation work of both the Interior and Agricultural Departments, and the officials of each with whom I have worked have seemed to me equally honest. I've disagreed with various policies of course, but I've never observed dishonesty among the officials, either great or small. I have observed it among some of the private companies with whom they've dealt. What is Mr. Dudley's evidence to the contrary?

ROBERT MARSHALL,
U. S. Forest Service.

DEAR PROFESSOR CHAPMAN:

I read your Montreal address on trends in forestry with much interest, particularly your conclusions as to federal regulation of timber cutting.

I have been following the reports of the Forest Survey in the various forest regions with great interest. The results do not indicate that the older alarms as to forest exhaustion were unfounded, but to my mind the reports do indicate that the American forestry profession, through education, research, and public and private forest administration, in fire protection and extensive forestry, has saved the situation, although there are many critical areas of forest devastation still needing attention. By and large, this is an achievement of professional forestry which the public should recognize.

R. B. GOODMAN,
Wisconsin Conservation Commission.